SCIENCE EDUCATION

Formerly GENERAL SCIENCE QUARTERLY

SERVING TEACHERS IN ELEMENTARY SCHOOLS, JUNIOR AND SENIOR HIGH SCHOOLS, COLLEGES, AND PROFESSIONAL SCHOOLS FOR TEACHERS

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THE MORALITY OF SCIENCE AND THE VALUES OF DEMOCRACY *

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THIS DISCUSSION of the role of science and democracy in the nurture of American children involves three presuppositions about the nature of education.

First, all deliberate education—humanistic, aesthetic, scientific, or utilitarian—is inescapably a moral undertaking. By *moral* I mean that education is always a deliberate effort to order means so as to achieve desired results, or outcomes, in the lives of individual human beings. Schools are founded, organized and maintained by adults, not by the children who are enrolled in them. Adults design and support schools because they want to make of their young something other and better than they would become if left to themselves and their surroundings. Our thought about education will be confused at its very root, if we assume that a school is a *morally indifferent* human enterprise.

Secondly, our educational activity will be more satisfactory and successful, if we know what we are about, when we are about the nurture of the immature members of our society. Education is an affair of human purposes, or ends; it is also an affair of human means and methods. Our ends and our means moreover are inter-related and both have consequences in the lives of children, and, through the children, in the course of the development of our civilization. Ignorance, vagueness, and mere "good intentions" are no more a virtue in education than in other spheres of human experience. The conviction that we should know what we are about when we undertake to guide the development of the young, is equivalent to the affirmation that teachers should have faith in intelligence. Indeed, intelligence may be defined as the ability to make a mature expression of human preference or purpose along with the ability to create and organize suitable means for the realization of our purposes.

The perception that a school will attain more satisfactory results when the children are accepted as partners in their own education is a contribution to educational method of the highest importance. But whole-hearted, purposeful activity on the part of children, and deliberate guidance on the part of adults are not mutually exclusive. The "new education" has suffered much from those ardent enthusiasts who have rashly assumed that respect for the child implies an educational program in which adults let "each child develop in his own way." The modes of life and thought of American civilization are not inborn, they are acquired by the young only as they learn them under the deliberate direction of adults. Were we really convinced that "baby knows best," we should never undertake to maintain a system of schools to select and direct the experiencing and learning of the young. Any educational program that does not have respect for what man has learned and achieved as a result

* Digest of a talk given at the Annual Meeting of the National Council for Elementary Science, held at the McAlpin Hotel, New York City, February 12, 1949.

of what he has suffered and undergone, cannot exhibit real respect for the child.

Thirdly, knowledge of American civilization is indispensable for those who seek to introduce the young to it. Grasp of the patterns and meanings of American life is nowhere more required, than among those who deal with children during the formative period when their basic intellectual and emotional dispositions are in course of development. Today, there is general recognition that democracy and science are two of the crucial patterns of American civilization. Despite the decrees of the Central Political Committee of the Soviet Union which affirm the inheritance of acquired characteristics, it is not necessary to prove to this group of science teachers that the folkways and thought-ways of a people are not biologically transmitted. They are reproduced in the lives of the new-born only through a process of experience and learning. It is time that American teachers made the principle that we learn our human attributes a major premise of their educational activity. Today, anthropology, sociology, and social psychology all unite in emphasizing the centrality of this principle. A democratic and a scientific mode of living is not "nature's" own and distinctive pattern. The values that we summarize under the names "science" and "democracy" are therefore not something to be taken for granted. They can be continued only as each new generation learns them all over again.

Democracy is a principle of group or human relationships. It is grounded in the conviction that each person should be treated as an end in himself, and that the members of a society have the right to determine the laws and institutions under which they are to live. Democracy is therefore both a form of government and a way of life. Its system of social and political organization makes its exacting demands upon all of its citizens. It has its responsibilities as well as its opportunities, its disciplines as well as its freedoms. No one can pretend to know what he is about, when he is about education *in* and *for* democracy, unless he perceives that he is seeking to nurture definite habits, attitudes, procedures, outlooks and allegiances in the life of each child.

Science also has its moral equivalents. It has a two-fold nature. On the one hand, science is a theory of knowledge, and a defined procedure or method by which man has learned to achieve control, and to attain warranted conclusions, that is, the kind of conclusions that we designate as "knowledge," the "facts," "law," or "truth."

But science is also bodies of organized knowledge. These organized systems of knowledge have been gradually developed in a wide variety of fields through the use of the experimental method of inquiry. The prestige of these scientific bodies of knowledge is high. In many areas they now condition our modes of perceiving and of interpreting the world in which we live. They also condition our view of human life, and the relation of man to the order of nature.

Many would hold that of these two elements, the method of science — its techniques, its instruments, and its procedures —is more fundamental than the bodies of knowledge which have been achieved through the use of this method. However that may be, we certainly misconstrue the kind of thing that science actually is, if we assume that it is exclusively a cognitive, or an intellectual, human interest. Science is a supreme *intellectual* practice, but that practice of intelligence which is science has its very definite moral foundations. When we undertake to introduce a child to science, we undertake to introduce him not simply to certain bodies of organized knowledge, but, above all, to a controlled method of human inquiry. This controlled experimental method of human inquiry is grounded in an exacting morality. Whenever this morality is repudiated, science itself begins to disintegrate. Scientific education is therefore something other than education

of the child in mere "open-mindedness"; it is a deliberate effort to commit the child to a procedure, a procedure that will dispose him to treat all areas of human experience and inquiry in a definite way. This commitment to a particular method of discovery and proof is a *moral* commitment. It involves choice among genuine alternatives; the mind that is "open" to science is "closed" to "wishful thinking" in all of its forms; it is "closed" to making external authority — military, hereditary, ecclesiastical, or political—the ultimate test of belief and value.

Hence we fail to assume full educational responsibility when we undertake to introduce the child to science, if we merely seek to give him knowledge of this or that scientific fact or law. To nurture the child in the way of science is to make him competent in the method by which its discoveries are made, and by which all findings, or human assertions, are tested and confirmed. This method has its disciplines, its loyalties, and its cooperative procedures. *Scientific* education is thus a basic part of *moral* education.

I shall give later a more detailed description of the morality inherent in scientific practice, but I want first to examine the basic meanings of democracy. It is my conviction that the values and methods of democracy, and the values and methods of science mutually involve one another. The evidence accumulates that each of these needs the other for its own fulfillment.

As I view it, the struggle for a democratic society, and for a democratic system of government, is at bottom a struggle to *socialize* and *humanize* the use of *power*. Perhaps I can most quickly explain what I have in mind by the use of an illustration of democracy actually at work. My example is drawn from recent history, and it relates to a series of events in that country which has on occasion been called "the mother of parliamentary government."

During an afternoon in the summer of 1945, two Englishmen went, one after the other, to have an official interview with their King. I shall briefly describe the occasion of these interviews.

The man who had the first of these audiences with the King of England is a member of what is known as the "ruling class" in Britain. He is a man of wide experience, an eminent writer, and a man with a distinguished record of public service. He had come to power as Prime Minister at one of the darkest hours in the long history of the British Commonwealth. His nation was at war, and it had just suffered a series of disastrous defeats. But this English leader was undaunted. His courageous spirit, his stirring words, his generous and bold statesmanship rallied and united his people. Under his leadership they won the epic "battle of Britain," and they gradually developed a world coalition that eventually won a total victory in the Second World War.

At the conclusion of the War, this Englishman was the foremost figure of Western European civilization. He had become one of the three outstanding leaders of the world. He decided to call a general election in order to get a new mandate for his government. In this national election he was the spokesman for the Conservative Party—the Party composed of the nobility of the land and the men of financial and industrial power. The election was fought mainly against the opposition of the Labor Party. This Party had also functioned during the War as a loyal part of the nationalist government of Britain.

Great things were at stake in the election. The members of the two parties were contending for the right to organize postwar Britain, and for the right to control the power of Britain in the making of the postwar world. The Labor Party was seeking a mandate from the people that would authorize it, if elected, to undertake a vast program of the socialization of productive property, including banking, the public utilities, coal, transportation, and steel. Their Party was led by a man of real ability, but he was not a particularly colorful figure,

and he had no great gifts of eloquence. He was of the middle class, and had served as a university instructor before he became a member of Parliament as a representative of Labor.

In this national referendum each adult had one vote. Somewhat to the surprise of both sides, the election went, not to Prime Minister Churchill and the Conservative Party, but to Clement Atlee and that coalition of workers and middle class people that is the Labor Party of Britain.

And now that the verdict of the voters was known, the Prime Minister, the national war-leader and hero, in accordance with the customs and laws of his country, was going to see his King. He was about to make an official report of the election, to turn in the seals of his office, and to advise His Majesty to call on Clement Atlee to form a Labor Government. Winston Churchill realized what the establishment of that Labor Government would involve. He knew that it meant the beginning of the liquidation of an Empire that the members of his own class had struggled for many generations to build; he also knew that it meant the collective ownership of forms of property that had long been controlled by his "ruling group" and which had been the foundation of much of its power.

But the general election had been fought at a time of his own choosing. Each side had had its due opportunity to present its case. Through their votes the people had spoken, and in seeking this audience with his King, Winston Churchill was recognizing and obeying the will of the majority. Thus the road to revolutionary changes in the domestic and world policies of Britain had been opened by a peaceful and orderly procedure in which heads were counted, not smashed, in which the appeal was to ballots, not to bullets.

This incident is an illustration of democracy at work. It is an historic example of the principle of socializing and rationalizing the control of economic, social and political power. The Labor Government, once it was installed, began to put through the program of legislation to which it had pledged itself during the election.

To achieve a society in which revolutionary changes can thus be accomplished by peaceful and orderly process many developments had to take place. For example, church and state had to be separated in an operational sense, and the power of the ecclesiastical forces brought under lay control, that is, under the control of the whole community. The power of the military had to be brought under the control and direction of the civilian forces. This is a great achievement and we would do wisely to guard it well. So also the power of hereditary groups had to be transformed and a political order developed in which each citizen should count as one, and only one. The power of the male had to be subordinated in a new social order in which women were given equality with men. Even the power that is "property" had to be taken from the status of an immutable, "natural" right, and brought under the dominion of the public good as progressively defined by the members of the state.

Above all, the civil liberties—the right to associate, to speak, to inquire, to publish, to propose, and to agitate—had to be made secure in the attitudes, the procedures, and the loyalties of a whole people. The principle of government through education, persuasion, and a system of free elections had to be enthroned in the hearts and the minds of a people. These are great moral and social developments. They signify the effort to make the method of reason prevail over the method of brute power; they also signify the effort to make the welfare of all prevail over the interests of any privileged minority group. The implications for education in this kind of a "free society" are many, and now that democracy is threatened we are beginning to realize that our schools must do their full part to nurture the young in the perspectives, the understandings, the attitudes, the loyalties, and the disciplines that are fundamental in government of, by, and for the people.

I turn now to consider the morality of

science, and the implications of that morality for the education of children. As the tragic events of the past thirty years have shown, a "free" science requires a "free" social order, and a healthy science requires a healthy social order, an order in which the discoveries and controls made possible by science, pure and applied, can be used to serve, not to destroy, humankind.

We sometimes speak of science as an "impersonal," objective process. Occasionally teachers of science assert that "science says," or "science pronounces." Actually science has no disembodied voice. It speaks only through ordinary human beings. All of its procedures, its techniques, its discoveries, have been developed not by superhuman forces, but by flesh and blood human creatures.

It follows that whatever we may mean by the objectivity and the authority of science, we cannot mean something nonhuman, sub-human, or trans-human. If this be true, how can we explain the authority and the universality of the findings and the deliverances of scientists? We get to the heart of the matter when we perceive that these valued traits of objectivity and universality are the fruit of the commitment of fallible human beings to a particular method. In brief, the findings of scientists have authority, because they are attained through a method that people have learned to trust. I shall enumerate five characteristics of that method.

First, the scientist is committed to stay within the realm of the *empirical*. By the *empirical* in data and method, I refer to those conditions and activities that can be shared—that is, that can either be observed or in some definite manner can be made explicit to all qualified investigators in a given area. Anything that is so esoteric in quality that it cannot be identified and shared with others is not sufficiently determinate in nature to be made part of the subject-matter and the operations of scientific inquiry. Nor is there anything arbitrary about this resolution to adhere to the realm of the empirical—it is obviously the only way by which we can gain the kind of evidence that makes it possible to distinguish the grounded from the ungrounded, the valid from the invalid.

This commitment to the empirical, or the publicly shareable, has far-reaching consequences. It has meant that such fanciful and impalpable constructs as fairies, demons, dragons, angels, ghosts and all other types of disembodied spirits are not accepted as part of the conditions, or the causal factors, used to explain any physical or human event. More and more teachers recognize they are already operationally committed in many realms to this principle of the empirical. Few teachers would excuse a lazy boy who asserted that his plants in the school garden were not doing well because they were suffering from an attack of demons and it was therefore useless to cultivate and spray them. In the human and moral realm, however, we have not as yet fully committed ourselves to the dominion of the empirical, and as a result we tend to nurture conflicting mentalities in the young.

Secondly, scientists are increasingly demanding that all ideas or hypotheses be formulated in functional, or operational, terms. The intellectual commandment of scientific method is to learn to think in terms of things to be done—of acts to be performed—as well as in terms of what we anticipate will happen as a result of that which we do. Indeed, the heart of scientific method is the hypothesis, and to be acceptable an hypothesis must meet two basic tests: it must define an act to be performed under definite and specified conditions, and it must also describe a result, or a situation that will come to pass, when the act described is actually carried out. In order to teach a child to think scientifically, we have to teach him to think in terms of definite, overt acts that will define, refine, test, reconstruct, and validate through public means that which he asserts is the case. An idea is significant only if it describes some

kind of functioning that is publicly verifiable. Truth denotes prediction.

Thirdly, the experimental scientist knows nothing of knowledge by immediate acquaintance. Nor will he accept as truth the arbitrary deliverances of any authority, no matter how venerable or exalted. For the experimental thinker, an idea is not a photograph or a poetic description of an external world, it is a defined plan of acting *in* and *on* that world. The test of the adequacy and the validity of an idea, therefore, is not how agreeable it is to our inner preferences or sentiments, not how luminous it seems to us personally, not how fast and hot our blood circulates when we entertain it in imagination, not its aesthetic and "emotive" properties, not our inability to think of any real alternative to the idea, but rather what happens when the idea is put to the test of practice. Authority is within the act and the consequences that flow from it; it is located in no other source.

Fourthly, the scientist further exhibits his commitment to a socialized procedure, by his demand for public records. He asks that each inquirer adhere to a practice which requires him to keep an accurate account of the conditions under which he undertook his observation or experiment, to describe with precision what he did, and to report accurately what were the effects or the consequences that followed from the doing, or the experimenting. This demand for accurate public records is but a further exemplification of the morality inherent in a process of verification that is open to inspection by all who qualify to inquire or to investigate in a given sphere.

Fifthly, the scientist demands that the hypothetical character of all results be recognized. Even experiments that have been confirmed over and over again are subject to the findings of new inquirers. Scientific conclusions are never absolute because it is recognized that they may be revised or modified by the inquiries of future generations. Thus Einstein revises the findings of a Newton, and the revision is regarded as a triumph, not a defeat, for science. This is because science has a principle of self-correction and improvement inherent in its established procedures. In other words, the findings of science, achieved through publicly conducted inquiries, are kept open so as to include the discoveries of generations still unborn.

It is thus through the socialization of its procedures that the scientific movement has freed the human process by which we reconstruct old beliefs and gain new knowledge from reliance on force, on external authority, on the esoteric, the intuitive, and the purely traditional. In fine, science has made the method of gaining a human consensus a function of a cooperative, empirical procedure.

Imbedded in the procedures both of democracy and experimental science is the old spiritual conception that it is by means of a universal, cooperative community that we can best achieve human security and welfare. The recognition of the basic ethical quality of these more fully socialized procedures prompt many to deplore current attacks on democracy and science. They perceive nothing spiritual about forces that seek to curb the development of science and democracy by condemning them as "materialistic" and "secular" in nature.

It is time that the split between earlier and more parochial attitudes, and these more public and universal methods is overcome. The best way to overcome this cleavage is through the education of the young. But to accomplish this requires a brave and free program of education—an education that will not retreat to pre-scientific and pre-democratic procedures and authorities but which will seek to introduce the young to the morality implicit in the socialized methods of democracy and science.

THE GROUP PROCESS IN SCIENCE EDUCATION

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You would consider it a foolish waste of time if I were to spend the next twenty minutes trying to sell democracy to you as a group of science educators. You do not have to be convinced about the desirability of a democracy. You accept democracy and cherish it as a way of life.

Why do we cherish our democratic way of life? Is it because we have grown up in a democracy and have become so accustomed to the general patterns of behavior which it fosters that we would not want to experience the inconvenience of changing? Or do we cherish democracy because we have some definite beliefs about human beings and find these beliefs expressed in what we call the democratic way of life?

Do we cherish democracy because we believe, among other things, in human beings as individuals; that people should participate in making decisions which will affect them individually and collectively; that individuals should have an opportunity to express their creative abilities; that facilities should be available whereby ideas that affect human welfare can be tested, accepted, modified or rejected by those whom the ideas affect; and, that people working together on common problems will come out with a better solution than any one of them could obtain alone?

Too often we are not entirely conscious of why we believe democracy to be better than some other way of life. I was never so impressed with this deficiency in my own thinking as when I was assigned the job of helping plan programs for the re-education of Japanese teachers after the occupation of Japan.

Prior to the occupation, Japanese teachers had gone through an educational program in which they had been trained in a pattern of behaviors that would make them loyal and obedient subjects of the Emperor. Unquestioning loyalty had been the basic objective in their education. As teachers they were required to teach a standard course of study which was designed to develop other loyal subjects. Their classrooms were inspected by government officials to be sure the prescribed course of study was being taught. Initiative and creativeness were discouraged, and the course of study was no better than some loyal subject in the Ministry of Education could make it. Teachers held classes according to prescribed procedures, enforced regulations, and kept their ideas to themselves, if they ever had any. Most Japanese teachers were satisfied and many were even happy in such a system of education, because these practices were not in conflict with their basic beliefs. Our attempts to impress these teachers with the values of a democracy required us to make a more critical examination of those values than many of us had ever done before.

In the process of trying to make the values of a democracy meaningful to people who had no concept of a democracy, an attempt was made to contrast practices in American schools with those in Japanese schools. In general these differences appeared to be great, but as one examined practices in American schools more closely, there was a tendency to lessen the magnitude of differences. One does not have to search far to find schools in our own country in which policies are consistently dictated to teachers by some higher authority; courses of study are handed down to teachers and students; permission must be obtained from higher authority for individuals or groups of teachers to exercise creativeness; classroom activities consist of learning and reciting answers; outcomes to be evaluated are determined by some central agency; and in which some teachers are happy in such an organization and resist any attempts to change it.

Who is responsible for such conditions existing in our American schools? The answer is obviously, —those of us who are educating teachers and school administrators. The people responsible for public education in America today reflect the type of educational program fostered and promoted by our teacher-education institutions. Can we then criticize public school teachers and administrators for practices, which we condemn as being undemocratic, until we have demonstrated democratic procedures in our own institutions? Again, the answer is obvious. Herein lies a crucial problem which we, as persons responsible for the education of science teachers, must solve.

We are obligated to help students, in our teacher-training institutions, understand the importance of people working together on the solution of common problems. We are obligated to help them learn the techniques essential for effective participation in such a group process.

Science educators have frequently expressed the belief that we should put greater emphasis upon the social significance of science. But in planning our programs we generally ignore this belief or merely talk about it as being an important outcome of science instruction. Does the scientific method have social significance in a democracy until we have learned to use it in the group process? Do the scientific attitudes have social significance until they function effectively in group thinking and action? Do the principles or generalizations of science have social significance until they become the knowledge basis of group action for common good?

Unless we as educators, administrators, teachers and citizens learn and use the techniques of working together more effectively, many of the values which we hold dear in the democratic way of life will not be realized. Those cherished privileges guaranteed to us by a democracy may be lost, because we were not capable of assuming the responsibilities which those guarantees demanded.

What, then, must we do? First, we, individually and as groups of educators in a particular institution, have to define and evaluate our beliefs about the democratic way of life. It is too risky to proceed, as we have in the past, upon indefinite and vague impressions about democracy. Next, we have to identify the behaviors which are essential for effective individual and group participation in the democratic process. Here again many of us are not too clear as to what an individual must be able to do in order to participate effectively in the process. Once we have identified these behaviors we must appraise ourselves in terms of them and take steps to overcome our own deficiencies. Finally, we must plan programs in science education that will develop these behaviors as important outcomes for our students.

Where do we begin? I believe we must begin with ourselves in our own schools and within our own science departments. We must begin with a realization, among ourselves as teachers of teachers and as administrators in our schools, that no one of us always has the best answer to questions regarding the planning and administration of programs in our department. We must accept the belief that each individual in our group has a unique and worthwhile contribution to make, providing the machinery is so organized. It must be recognized that educators who have the responsibility for administering policy or programs can do it more effectively if they have participated in their development. We must recognize the probability that we need group experience in identifying curriculum and instructional problems in our schools; in analyzing these problems; in evaluating and using source personnel and materials; in arriving at group decisions; in evaluating decisions; and in planning programs of action.

As we contemplate doing something about providing ourselves and our students with opportunities to participate in the group process, it might be well to identify some of the obstacles. There have been a number of obstacles which have prevented the group process from operating effectively at the

staff level in some institutions. In too many instances there has been a tendency to accept statements of policy from administration without questioning when those policies were of such a nature that they should have been challenged by the people whom they affected. Some science teachers resent questions regarding course programs for which they have always assumed individual responsibility, thus blocking objective consideration of curriculum problems. Many of us have avoided participation in general program planning because we have considered ourselves to be botanists, chemists, zoologists and physicists and not primarily educators. We tend to become exasperated at the slowness of the group process, whenever it has been tried, and as a result often become eager to delegate the responsibility for making decisions to some one individual. We have overemphasized the uniqueness of science in relation to other areas of human endeavor. Too often we become preoccupied with trivial routine matters whenever we get together as a staff.

In the classroom numerous factors have operated as obstacles to the group process. Exclusive emphasis is often put upon learning subject matter as such. This is generally based upon the assumption that an individual in a particular course can learn all the subject matter he'll need, and that we will need all available time in order to do it. We have held to techniques of teaching which have long since been proved ineffective in achieving the aims of science education. Individual achievement has been overemphasized at the expense of group achievement. The physical arrangement of our classrooms has not been conducive to group work. As teachers, many of us are unfamiliar and inexperienced with the techniques of the group process. We are not aware of the types of problems with which the group process could deal most effectively.

The possibilities of science teachers working together with lay people upon problems of community concern have hardly been explored. There are probably a number of reasons for this. It may be that we do not participate in community activities of great social significance. As a result we have not developed a sensitivity to community problems. Many of us are insecure outside our area of specialization in science and tend to resist any forces that would carry us away from our specialization. Then too, we may believe that our responsibilities for educational leadership in the community end when we leave the confines of the school building.

If science education is to contribute to the education of people for effective participation in a democracy, it must provide opportunities for people to learn how to use science in working together upon common problems. We, as science teachers, must learn how to use the group process in our staff relations, in the classroom and in working with lay people in the community, if science education is to achieve this important function.

DEVELOPMENT OF CONCEPTS IN ELEMENTARY SCIENCE *

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Since the publication of the Thirty-first Yearbook by the National Society for the Study of Education, several series of textbooks in science for use in the elementary school have appeared. The need was then and is at present for a well balanced continuous program in science for the elementary school aimed toward a more complete realization of the commonly accepted objectives of science education.

A study of the five most widely used

* Paper presented at the National Association for Research in Science Teaching meeting at Atlantic City, New Jersey, February, 1948.

textbook series in elementary science recently completed by the writer reveals many startling facts pertinent to the problem. The study involved the determination of the areas included, topics discussed, and concepts presented in each series at each grade level as well as the concepts presented in each area disregarding the grade levels.

The first part of the study was made to determine the areas or over-all classification of the content included in these series. Some of the areas are: animals, balance of nature, electricity, etc.

The number of different areas included in the six grades varies from 21 in Grade I to 41 in Grade VI. In Grade I the number of areas included in the individual series ranges from 12 in one series to 21 in another. This condition exists at all grade levels.

The agreement concerning the areas included is revealed from the number of areas included in four or more series at the six grade levels. For example, in Grade IV 28 of the 38 areas are included in four or more of the five series.

TABLE I

AGREEMENT AMONG THE FIVE SERIES ON THE INDIVIDUAL GRADE LEVELS WITH REFERENCE TO THE AREAS INCLUDED

Grade	Total Areas	Number of Areas in 4 or More Series	Per Cent of Areas in 4 or More Series
1	21	14	66.7
2	29	18	62.1
3	33	20	60.6
4	38	28	73.7
5	40	28	70.0
6	41	28	68.3

There is better than 60 per cent agreement among four or more of the series concerning the areas included on the individual grade levels.

A consolidation of the different areas presented in the five series at the six grade levels into a single list revealed that there are 42 different areas included in the five series in the six grades. This consolidated list of areas also revealed that only 22 or 51 per cent of the areas were repeated at three or more grade levels.

The second step in the study was made to determine the degree of agreement concerning the topics discussed in each area at each grade level. A topic was defined as a unit of study based on a single idea as: reproduction, seeds, pollination, etc.

The number of different topics discussed increased progressively from 110 in Grade I to 793 in Grade VI.

TABLE II

AGREEMENT AMONG THE FIVE SERIES ON THE INDIVIDUAL GRADE LEVELS WITH REFERENCE TO THE TOPICS DISCUSSED

Grade	Number of Topics Discussed	Number of Topics in 4 or More Series	Per Cent of Topics in 4 or More Series
1	110	46	41.8
2	277	79	28.5
3	365	81	22.2
4	501	110	21.9
5	582	149	25.6
6	793	134	16.9

The greatest portion but the smallest number of topics discussed in four or more series is found in Grade I where 46, or 41.8 per cent of the 110 topics appear in four or more series. The smallest portion of the topics appearing in four or more series is 134, or 16.9 per cent of the 793 topics in Grade VI. The greatest number of topics agreed on in four or more series is found in Grade V where 149, or 25.6 per cent of the 582 topics are discussed in four or more series.

Analysis of the original data in the study revealed that there are four areas, two in Grade I and two in Grade V, in which the degree of agreement among 4 or more series concerning the topics discussed is equal to or exceeds 75 per cent.

It is observed that the degree of agreement at all grade levels is smaller when the topics discussed are employed as an index rather than when the areas included are employed.

The third step in the study was to determine what concepts were presented in the discussion of each area at each grade level. A concept is defined as "an idea or expres-

sion representing the common element or attribute of a group or class. A generalized idea including all that is suggested to an individual by an object, symbol or situation." [1] Some of the concepts presented are:

All living things are either plants or animals.

All living things must have air.

The new material added during growth is made by living things from the food used.

Every living thing on earth depends upon other living things for its life.

The number of different concepts presented at each of the six grade levels ranges from 450 in Grade I to 3,943 in Grade VI. The number of concepts presented in the five series at a given grade level also shows great variation. Some of these variations are: Grade I from 102 to 212, Grade II from 218 to 674, Grade III from 360 to 658, Grade IV from 614 to 1,026, Grade V from 818 to 1,670, and in Grade VI from 715 to 1,861.

TABLE III

Agreement Among the Five Series on the Individual Grade Levels with Reference to the Concepts Presented

Grade	Number of Concepts Presented	Number of Concepts in 4 or More Series	Per Cent of Concepts in 4 or More Series
1	450	58	12.9
2	1136	104	9.2
3	1493	135	9.1
4	2239	167	7.5
5	3469	276	8.0
6	3943	176	4.5

The variation in the number of concepts presented is minimized by the variation in the actual concepts. The highest degree of agreement concerning the concepts presented is found in Grade I where 58 or 12.9 per cent of the 450 concepts appear in four or more series. The greatest number of concepts appearing in four or more series is found in Grade V where 276, or 8 per cent of the 3,469 concepts appear in four or more series. The lowest degree of agreement is found in Grade VI where 176, or 4.5 per cent of the 3,943 concepts appear in four or more series.

An examination of the original data revealed that there are six areas included in the six grades in which the degree of agreement concerning the concepts presented is equal to or exceeds 30 per cent but at no time reaches 40 per cent.

The portion of the concepts presented at the individual grade levels in the five series on which there is no agreement, that is they never appear in as many as two series in common, ranges from 50 per cent in Grade I to 65.2 per cent in Grade VI.

The distribution of the concepts between the Biological Sciences and the Physical Sciences reveals some interesting facts pertaining to the balance existing in the present day elementary science programs as indicated by the content of the five series of textbooks.

The range in the per cent of the number of different concepts presented in the five series devoted to the Biological Sciences is given for the six grades.

TABLE IV

Range in the Per Cent of the Concepts Presented in the Individual Series on the Six Grade Levels Devoted to the Biological Sciences

Grade Level	High	Low
1	82.4%	62.1%
2	76.2	47.0
3	83.4	60.7
4	69.4	46.6
5	80.7	49.0
6	58.5	46.0

More than 50 per cent of the concepts presented in four or more of the five series at four of the six grade levels are devoted to the Biological Sciences.

The fourth step in the study was to determine whether the lack of agreement was due to a difference in the grade placement of the concepts or in the actual concepts presented, so a consolidated list of all the concepts, the series presenting each, and the grade level at which each was presented, was prepared.

Of the 8,913 different concepts presented

[1] Carter V. Good, *Dictionary of Education*, p. 90. New York: McGraw-Hill Book Company, 1945.

in all of the six grades, only 1,464, or 16.4 per cent of them appear in four or more series. This is a far greater degree of agreement than is found at any individual grade level.

Considerable variation was noted in the number of concepts devoted to each area. The area of Health and Safety included the greatest number and per cent of the concepts which was 898 or 10.1 per cent of the total for the six grades. Only 103 or 11.5 per cent of these concepts appeared in four or more series. The area of Atmosphere included the smallest number and per cent of the concepts which was 23, or .26 per cent of the total presentation. Only five or 21.7 per cent of these concepts appeared in four or more series. The highest degree of agreement was found in the area of Living Things in which 26, or 34.7 per cent of the 75 concepts appeared in four or more series. There are 13 areas in which the degree of agreement equals or exceeds 20 per cent.

By the end of the six years of elementary school training, if any one of the five series of science textbooks is adhered to, the pupils will have been subjected to some portion of the 8,913 different science concepts but will have in common only 1,464. It is further observed that of this 1,464 concepts in common, 880, or 60.1 per cent are in the field of the Biological Sciences. In further detail it is noted that 645 of the concepts pertain to plants and animals alone.

On the basis of this study the following observations are noted:

There is a fair degree of agreement noted in the content of the five series of elementary science textbooks when the areas included are used as an index.

There is a relatively small degree of agreement noted in the content of these five series when the topics discussed are used as an index.

There is an extremely small degree of agreement noted in the content of these five series when the concepts presented are used as an index.

There is a greater degree of variation in the grade placement of the concepts than in the actual concepts presented.

More than 50 per cent of the science concepts presented in the five series refer to the Biological Sciences.

There is little or no agreement among the authors of the present elementary science textbooks concerning what or how much science should be included as a part of the experience of elementary school pupils.

The content of the five series of elementary science textbooks analyzed may be characterized as descriptive in nature and designed to serve as a reader rather than as a science textbook.

FIRST GRADE CONCEPTS OF HOT AND COLD

GEORGE W. HAUPT

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A PREVIOUS article [1] presented an analysis of concepts of the moon which were held by children in a First Grade. The data of the present article come from the same children. Children of First Grade were chosen for these studies because research on the ages represented by this level are not as extensive as those for the ages represented by higher grade levels.[2]

These concepts of Hot and Cold were obtained by use of the same procedure as used for obtaining the concepts relating to the moon. Free conversation is an essential feature. The children are asked to talk about selected topics (in this case,

[1] Haupt, George W. First Grade Concepts of the Moon. *Science Education*, 32:258–262, October, 1948.

[2] Isaacs, Susan. *Intellectual Growth in Young Children*. Harcourt, Brace and Company, 1930.

Hot and Cold). There is no interrogation.[3] Particular answers to particular questions are not sought. Particular lines of response are not suggested.[4] Discussion follows the desires of the children.

Twenty five children comprised the class. They were pupils in the First Grade of the Laboratory School of the New Jersey State Teachers College at Glassboro. The group was taught by the regular classroom teacher.[5] The teacher incorporated suggestions from the author. The author observed and recorded. The range in I.Q. was from 102 to 133. The range in C. A. was from 5:6 to 7:5.

What categories describe the content of the responses of these children? These children talked about Hot and Cold in terms of Production, Effects, and Thermometer. There was little overlapping among the categories. The concepts are presented by categories.

THE CONCEPTS

The statements are given in the words of the children. The order of array is not theirs, however. For example, several of the children interspersed remarks concerning Thermometer with remarks concerning Production. Such interspersals are of considerable importance and analyses will be attempted in another study. For present purposes, integrity of statement is considered sufficient.

Production

Wood gets hot when you sandpaper wood—burns your hand.

Rub stones together and you will get heat.

On play trains the tracks get hot.

My sled made sparks once when I went down hill. I had to put snow on the sled, it was so hot.

You can make heat by lighting a fire or stove.

Put oil on the stove and the oil will get hot; sparks leave sometimes.

Get sticks together and you can make a fire.

The transformer on a play train gets hot—the wires burnt off.

I stuck a hairpin in a plug and got sparks and it got hot.

Scouts take a magnifying glass and make fire on paper.

You can make heat by putting your hand on the table and the table will get hot.

Effects

The sun made the snow man disappear.

The snow man disappeared and went right into the air even while the wind blew. But the wind did not blow the snow man over.

We would have fog and rain all of the time without the sun.

You can tell if it is warm by feeling a piece of glass.

Thermometer

The mercury stretches in the heat.

The little round thing in the thermometer goes up in the heat—it is red. I think it is glass. It is silver stuff. My brother has some.

Heat hits the little silver thing and the little thing goes up. The mercury goes up.

Cold air makes it go down.

The air makes the thermometer get bigger.

ANALYSIS OF THE CONCEPTS

This analysis is made, primarily, for teachers and prospective teachers. Attention is given, however, to several problems that are of interest to students of child psy-

[3] Piaget, J. *The Child's Conception of Physical Causality.* Harcourt, Bruce and Company, 1930.

[4] Johnson, M. W. Language and Children's Behavior. *Elementary School Journal,* 46:141–145, November, 1945.

[5] Mrs. Margaret N. Rieck.

chology. Accordingly, the discussion seeks to balance theory and practice. In other sections of this article teachers will find further considerations that are of direct classroom application.

Production

These children speak in terms of five methods of producing heat. The methods are: Friction, Oxidation, Transformation From Electricity, Transformation From Light, and Conduction. The data yield no evidence that these children could have defined any of these five methods. Of course, if they could not have defined the methods they could not have classified their own remarks. An important problem is involved here: to what extent could children of First Grade level be taught to abstract such methods and then, therewith, classify their experiences?

The frequency of statement is greatest for Friction and least for Transformation From Light and Conduction From the Body. Since all of the statements relating to Production are observations we infer that the frequency gives an index of the extent of the pre-school experiences of these children. Frequencies such as this might be used by teachers as guides to experiences that have not been shared by many children in a class. Thus, in this case, we could proceed with instruction relative to Friction with provision of fewer basic experiences than with instruction relating to Transformation From Light.

Influences of environment on the formation of these statements are evident.[6] Most of the statements describe experiences that are possible for children of every social and economic level. But the statement, "The transformer on the play train gets hot—the wires burnt off," involves an experience which some of our children could not have had (at their home, anyway). Similarly, though to a lesser extent, for "I stuck a hairpin in a plug and got sparks and it got hot." So we see how possibilities of in-school learning are conditioned by pre-school environment. The question of the relative influences of environmental experience and maturation on child learning in science is important.

Effects

These children speak of two effects of heat. These effects are Evaporation and Conduction. As with the statements relating to Production, we have no evidence that these children were aware of the meanings implied by our classifications. We are not absolutely certain from these data that, in one case, phenomena of Melting are not implied—"The sun made the snow man disappear." However, the classification provides evidence of the kinds of heat effects which these children have experienced.

The frequency is greater for Evaporation than for Conduction. Also, besides frequency, the statements concerning Evaporation are more complex than the statements concerning Conduction. For these data, this is the closest correlation of frequency and complexity.

Note that the word "Disappear" is used in place of "Evaporate." Structurally, the two words are of equal difficulty. Is this usage significant? Significance may lie in the process of concept formation.[7] Logically, "Disappear" is the genus of which "Evaporate" is the species. This usage may provide a valuable guide to teaching procedure. When teaching Evaporation should phenomena of disappearance be presented before evaporation is presented as a special case of disappearance?

"The snow man disappeared and went right into the air even while the wind blew. But the wind did not blow the snow man over." This is an instructive pair of sentences in spite of some difficulties of interpretation. The beginning of the first sentence indicates that phenomena of evaporation are implied (went right into the

[6] Isaacs, Susan, *op. cit.*, pp. 67 and 82.

[7] Welch, L. A Preliminary Investigation of Some Aspects of the Hierarchical Development of Concepts. *Journal of General Psychology*, 1940, Volume 22, pp. 359–378.

air). The conclusion of the first sentence, however, presents ambiguity ("even while the wind blew"). Does the child mean that, because of a cooling effect, the wind should have prevented the snow man from "going right into the air"? Children do cool their soup, oatmeal etc. by blowing (wind). Therefore, does the child mean that, even though the snow man was cooled by wind, it continued to go "right into the air"? The second sentence could support this interpretation. In the second sentence the child could be adding a thought such as this: but, after all, the wind was not so strong (cooling) and, so, the snow man could have disappeared (evaporated). The two statements of this child, studied together, emphasize the value of interrogation.[8] A few exploratory questions could have given this child opportunity for much clarification of a causal nature.

The statement relative to fog and rain contains causal implications. The child says, in effect, that the sun causes fair weather (no fog and rain). With this exception, the conversational intercourse of these children evidences no causal explanations. Their remarks are factual and descriptive. It can be concluded, of course, that with other procedures explanations could have been obtained. The data show that these children, as Piaget's did under similar circumstances,[9] describe without explaining.

Note the similarity of "You can tell if it is warm by feeling a piece of glass" to "You can make heat by putting your hand on the table and the table will get hot." In both cases explanation, if given, would involve concepts of conduction. Had these children been questioned closely, would they have offered the explanation that is common with this age level viz., the explanation in terms of passage of a substance or fluid? To what accuracy and complexity would their explanations have ascended? Would the children have explained the glass and the table in the same way?

Thermometer

These children know the results of the action of heat and cold on a thermometer. They know what the thermometer does in contrasting temperatures. They do not explain the action.

Two statements bear upon a question discussed for phenomena of Disappearance and Evaporation—the question of development of concepts from generic to specific. The child says, "Cold makes it go down" and "Air makes the thermometer get bigger." Heat is not differentiated from a larger complex, Air. For this child, Heat is synonymous with Air. We need careful studies of modes and stages in children's progressively differentiated interpretation of the world.[10]

COMPOSITE DISCOURSE
(RECONSTRUCTED)

The children's statements are now given in consecutive discourse. Such discourse is as if one child relates the thoughts of the entire class. In several places, continuity is maintained by additions and shifts of wording. However, the style of the children is preserved.

Prospective teachers, teachers, and students of child psychology may profit from study of this discourse. Prospective teachers may obtain a "feel" for a First Grade class. Teachers may find suggestions for lessons. Students of child psychology may discover, in these products of thought, leads to investigations of processes of thought.

You can make heat in six ways. You can make heat from fires, rubbing, a transformer, a plug, a magnifying glass and yourself.

[8] Piaget, J. *The Child's Conception of Physical Causality.*

[9] Piaget, J. *The Language and Thought of the Child.* Chapter II.
——— *Judgment and Reasoning in the Child.* Harcourt, Brace and Company, 1928, p. 253.

[10] Heidbreder, E. F. Attainment of Concepts. *Journal of General Psychology,* 35:173–223, October, 1946.

If you want heat from fires you can use sticks or oil. If you use oil the fire will get so hot that, sometimes, sparks will leave.

If you want heat from rubbing, you can use two stones. Or, you can sandpaper wood. Sometimes, play trains rub on the track so hard that the track gets hot. Even a sled rubs on the snow so hard that sparks come from the sled and you have to rub snow on the sled to cool it.

Transformers and plugs give heat. The transformer on my play train got so hot that the wires burnt off. The same way with a plug. When I stuck a hairpin in a plug it got so hot that it gave out sparks.

You can make heat with a magnifying glass. Scouts do this. Scouts take a magnifying glass and make fire on paper.

Here is another way to make heat. You can put your hand on a table and the table will get hot. You can tell if something is warm this way, too. You can tell if a piece of glass is warm by feeling it.

Heat will do things. Heat makes things disappear and it makes good weather.

I saw the sun make a snow man disappear. The snow man went right into the air. When the snow man disappeared the wind was blowing but the snow man disappeared anyway. Yet the wind was not blowing very hard for the wind did not blow the snow man over.

The sun helps us to have good weather. We would have fog and rain all of the time without the sun.

Heat makes a thermometer work. Heat hits the little silver thing and the little silver thing goes up. The little silver thing is mercury and it stretches in the heat. When the air is cold the thermometer will go down and when the air is warm the thermometer gets bigger.

OPPORTUNITIES FOR INSTRUCTION

The statements of these children reveal an observational basis for explanatory lessons. The extent of such explanation will vary, of course, with every teacher and with every class. But the possibilities of approach to explanatory goals are inherent in the statements. Here are goals to which explanation of the children's statements may be directed.[11]

Production of Heat

Motion changes to heat.

Electricity changes to heat.

Light changes to heat.

Heat "flows" from warmer to colder object.

Heat transfers by conduction.

Burning is a process of combining with oxygen.

Effects of Heat

Melting is a process of heat absorption.

Evaporation is a process of heat absorption.

Thermometer

Addition of heat causes expansion.

Subtraction of heat results in contraction.

Heat is a form of energy.

Cold is relative absence of heat.

SAFETY TEACHINGS

With increased emphasis on safety education in the elementary school two methods of instruction are developing. One procedure reserves a special period for safety. Another procedure correlates safety instruction with experiences as they arise in the content areas.[12] Examination of these data indicates some of the possibilities for

[11] Relative to explanatory goals, teachers and prospective teachers should study the following:

Craig, G. S. "Certain Techniques Used in Developing a Course of Study for the Horace Mann Elementary School." (Curtis, F. D. *Second Digest of Investigations in the Teaching of Science*. Blakiston, 1931, pp. 40–52.)

Haupt, G. W. "An Experimental Application of a Philosophy of Science Teaching." (Curtis, F. D. *Third Digest of Investigations in the Teaching of Science*. Blakiston, 1939, pp. 19–27.)

Robertson, M. L. "A Basis for the Selection of Course Content in Elementary Science." (Curtis, F. D. *Third Digest of Investigations in the Teaching of Science*, pp. 3–19.)

[12] Haupt, G. W. Remarks: Elementary Science and Fire Safety Education. National Fire Protection Association. *Proceedings of the Fifty-second Annual Meeting*, 1948, pp. 59–61.

safety instruction as part of the science experiences of children.

These children evidence an experience basis for instruction in the following areas of Fire Safety Education:

Heat From Friction
Wood. Stones. Metals. Sparks from metals.

Danger From Oil Fires
Oil gets especially hot—gives sparks.

Fire From Electrical Equipment
Wire burnt off.

Danger From Electrical Resistance
Sparks from plug.

ASTRONOMY—LET IT BROADEN YOUR MENTAL OUTLOOK OR EARTH-UNIVERSE PERSPECTIVE THROUGH ASTRONOMY

John Sternig
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The average inhabitant of our planet is still just as earth centered in his mental outlook as though Copernicus had never been born. It is true that our schools teach children to recite the proper facts about the sun and the planets, but in the actual day by day living which we do, most people still feel and act as though the earth were the center and the end of all things. Thus, while we accept the intellectual concept of a Heliocentric system, we live our lives in a geocentric way. We live largely by our five senses rather than by our intellects.

If we want correct earth-universe perspective we must free ourselves from time to time from mundane things and turn our eyes up to the heavens. So long as we remain earth-bound we cannot understand the scheme of the universe. The earth seems so vast, our lives so intimately circumscribed by the physical fact of its existence that we quite naturally keep our mental as well as our physical existence upon a rather "earthy" plane. What we fail to grasp is that it is not so much our earth which is large as that we, who live on it, are small. This is a "relative" universe in which we exist. It has been said that man stands half way between the atoms and the stars. So if we look toward the microcosm we seem large indeed, but the macrocosm dwarfs us into utter insignificance. Man needs to consider both to establish proper perspective, yet most of us seldom think of either.

Go out some night and gaze at the moon —not romantically, but scientifically and philosophically. The moon looks like a small bright orb, a flat disk against the flat blackness of the sky. But consider its real nature. There floats a world, suspended in space and held in its course around the earth by the bonds of gravity. It is our nearest neighbor, yet its average distance is about 238,000 miles from us. Astronomically this is a mere skip and a jump as we shall see. In size also the moon is insignificant, only one fourth the size of the earth. Yet its apparent diameter in the sky is almost exactly equal to that of the sun which we know to be over one million times the volume of the earth. Here is relativity again. The sun's diameter is 400 times that of the moon but its distance is 400 times greater too, hence the apparent size in the sky is the same for both. You cannot believe your eyes alone, for the evidence of our senses is often misleading.

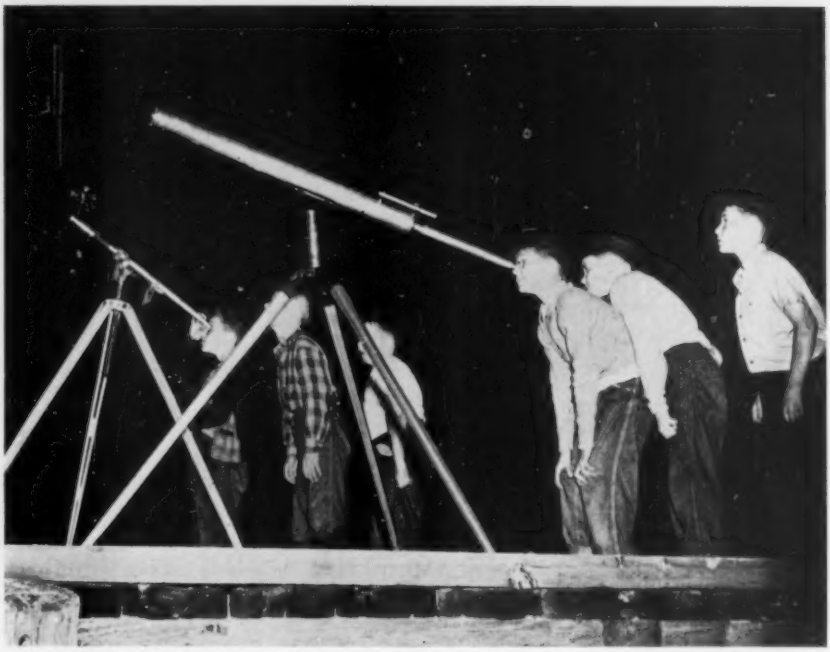
But suppose you turn your eyes from the moon to places farther out in space. In considering some of these we need to establish another measure of distance in place of

OBSERVING SUNSPOTS

miles, since these become so great as to be incomprehensible. Astronomers use LIGHT TIME, the distance which light can travel in a given time at its rate of 186,000 miles per second. On this scale the moon would be only one and a third seconds of light time away. It might be interesting also to consider travel time to various places by anticipating atomic powered rockets by a few years; rockets capable of traveling 25,000 miles per hour which is the speed of release from earth's gravity. At this speed we could reach the moon in about ten hours.

As we look further into space we see the planet Mars, our next nearest neighbor outward from the sun. At its closest Mars is about 35 million miles from us, a matter of only 3 minutes by light time or 58 days by rocket ship.

It is not likely that rockets traveling no



Night Class in Astronomy

faster than the speed of release would go much beyond Mars since the next major planet, Jupiter, is about 480 million miles out, nearly two years away by rocket. Light time, however is only 33 minutes. Next comes Saturn, then Uranus and Neptune and finally Pluto at the far end of the Solar system over 3½ billion miles out. Rocket time to Pluto would be about 17 years and light requires five and a half hours to reach us from there. This is the known extent of the solar system and already we are conscious of vast distances as compared with the small distance to the moon—a solar system of more than 3½ billion miles radius; five and half hours of light time.

But even this is still in our own back yard, for to reach the nearest star after we leave Pluto would require passage across some 25 trillion miles of space, 120,000 years by rocket, or 4⅓ years by light time. Consider for a moment—17 years by rocket to the *farthest* planet and 120,000 years to the *nearest* star or 5½ hours compared with 4⅓ years. Beyond this nearest star there are about 100 billion other stars, each separated from every other by many light years of space. The total galaxy of stars is so vast that light requires about 100,000 years to cross from one edge to the other. This may begin to give the reader some notion of the scale of things, but lets reinforce the idea even more.

Dr. O. J. Lee, former director of the Dearborn Observatory makes this interesting comparison. If the solar system were reduced to the diameter of an ordinary drinking glass, the galaxy of which it is a part would have to be represented by the entire continent of North America.

Yet this galaxy of ours, with all its billions of stars, is only one of millions of such galaxies which fill the universe of space, each galaxy separated from every other one by nearly 2 million light years of distance. Sir James Jeans once estimated that in all the galaxies of the universe there were probably as many stars as there are grains of sand in all the beaches of the earth.

Such numbers are impossible to truly

comprehend but perhaps this example may establish the concept of immensity more clearly. Suppose you wished to count the number of miles in just one light year, about six trillion. If you counted one mile per second, day and night without ceasing, you could count one million in about twelve days. It would take about 34 years to reach one billion and 34,000 years to count one trillion. You would then have to go on six times that long to count the miles in one light year. The mind begins to reel under the impact of such numbers and such distances.

But come back now from the far reaches of the Universe, from galaxy to galaxy until you reach our own; from star to star within it until you reach the sun, one small star among the billions. Then look for planet earth, seen now in true perspective as just a tiny speck of matter circling a spark of light. It does not seem so large now, or so important.

And what of man? To what utter insignificance he shrinks! We come back from such a mental journey humble but not humiliated. For even as we humbly accept our physical insignificance we realize that the true value of man is not in his physical body but in the human mind which can comprehend all this. Thus a simple truth springs sharply into focus: Man's physical body is as nothing, but his soul and mind are all-important.

It must have been some such reflection which once prompted Abraham Lincoln to say, "I can conceive how a man might look upon the earth and be an atheist, but I cannot understand how he could look up to the Heavens and say there is no God."

ELEMENTARY SCIENCE EDUCATION

ANNA M. GEMMILL

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AMONG THE pressing needs of Elementary Education today is one for a functional course in science. Some states have such a program but many of the teachers are afraid to attempt it. Over and over the teachers say, "I am not a scientist. I have had practically no science." If such teachers only knew the fun of teacher and pupils working together on a problem in science saying, "I don't know either but lets try to find out," they would be eager for the adventure.

Teachers seem to be afraid of initiating science activities. They are apt to impart facts only or the science period degenerates into a reading period. Some one once said of elementary science, "The giving of subject matter as such is a cinch and a sin."

What should be done? Teachers should, together with the class, observe, engage in various simple activities and experiments, read and if possible get out into the outdoors for the work in science.

There should be a continuous science program from kindergarten through the six grades, the junior high school and into the senior high school where certain phases of science could be placed on an elective basis. It should be a course so planned that each year's work and experiences are built upon the work and experiences of the previous year.

In the writer's own experience she found that teachers had a tendency to teach a complete, well-rounded logical unit of science. In this way they "skimmed the cream" and encroached on the work of the following years. It was difficult to convince them that children simply do not think that way. Children get a small part of the concept and then it gradually grows larger as they grow and increase their contacts and experiences.

When once the teachers were safely

guided between the Scylla and Charybdis of logical arrangement of subject matter and recitation lessons in science, they loved the New York State syllabus in Elementary Science. When they understood that it was suggestive, not mandatory they worked with great enthusiasm. It was fun to show them the local riches that lay almost at the door of their schoolhouses.

The writer is most familiar with the Elementary Science work of New York State. She worked with elementary teachers both in college and in the field in an effort to make clear the goals and procedures implicit in the syllabus. Especial emphasis was laid on local problems.

The New York Syllabus has been judged by an expert to be the best in the field. Be that as it may, it does provide a wealth of information for the teacher. As was repeatedly said, "If a teacher really wants to teach the program she can do it without any special science training if she will use the syllabus."

There have been three editions of the syllabus or bulletin, each one based on the experience derived from use of the previous one. For that reason the syllabus commands respect. There is no "ipse dixit" in the State Department of Education and that keeps the program a growing living thing.

Two experiences from the field of science instruction may be of interest. In one of my Elementary Science Classes in summer school a school principal who was likewise a supervisor of instruction appeared. Upon being asked what he wanted from the course he wrote, "I want to find out if this elementary science is as difficult and impossible as my teachers say." During the course he constructed a curriculum for his own system based on the State syllabus and using local material. At the end of his work he remarked, "Boy! Just let those teachers try to tell me they can't do it because of expense and difficulty."

A rural school teacher arrived late in the afternoon one day with this question, "Where can I find out about the praying mantis? We have some." The average zoology text book, various reference books and the college library, all failed to furnish much pertinent information. So the teacher returned to her class. After consultation it was decided that,

(1) The teacher should go to a near-by large city and consult the libraries and museum.
(2) A group of pupils should visit the fields and try to learn of the insect's behavior there.
(3) A group of pupils should make a careful study of the insects already captured.

After this had been done, a second meeting of the teacher and all the groups would be held. The new information would be presented, discussion would follow and they would list what they had actually learned.

This procedure was no different from that which any teacher could follow. It did not require scientific training but it did require a desire to solve the problem and the knowledge of how to acquire the necessary information. It was following John Dewey's advice. "Surround the child with opportunities to observe, to explore, to interact, to interpret." In short it was good teaching. Lack of preparation will never stop a teacher if she is well trained in the philosophy of education and really wants to do a good job. The child's way of growth is to develop inner satisfaction, self-expression, and self-realization. It is the wise, trained teacher who can encourage and direct the growth of this inner force.

It has always seemed to me that elementary science is peculiarly fitted to develop the widening interest of the child. It provides a wide range of contacts with his environment; and it also provides (or should provide) a teacher to help set up the problem, to advise in selecting suitable activities, to help find the necessary book materials and to give other help whenever needed. The class, when rightly handled, will furnish the stimulation of classmates

interested in the same problem and the atmosphere of achievement without which the work certainly lacks satisfaction.

To quote from the 31st year book National Society for the Study of Education, Part I,

If pupils have:

"(1) an ability to utilize the findings of science that have application in their own experience.

"(2) an ability to interpret the natural phenomena of their environment.

"(3) an understanding of, an ability to use some of the methods of study that have been used by creative workers in the fields of science,"

they have obtained definable values from their study of science and are obtaining in some measure one of our aims, "Life enrichment through education."

IN-SERVICE AND PRE-SERVICE PROGRAMS FOR IMPROVING SCIENCE TEACHING IN THE ELEMENTARY GRADES *

PAUL E. BLACKWOOD

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IN WHAT ways may in-service and pre-service education prepare teachers to work with children in using science methods and materials to help children live most effectively in a democratic society? This broad question set the stage for the panel [1] discussion at the annual meeting of the National Council on Elementary Science in New York, February 12, 1949. In order to deal with specific aspects of the problem of training teachers, the group considered five questions. The questions together with the points related to them are summarized here:

1. What are some of the blocks to effective science teaching?
   a. Teachers don't feel at home with science materials and content.
   b. Teachers are fearful of having their science teaching challenged in terms of facts acquired.
   c. Teachers do not know how to apply democratic procedure and scientific methods in working with children, and they hesitate to accept the challenge so often given that they should "grow with the children."
   d. The lack of administrative support for science programs.
   e. The difficulty of arranging for time in an already crowded daily schedule.
   f. Teachers cannot see the relationship of science experience to the other work of the class.
   g. The departmental organization in many schools limits the use of children's interest as a basis for science programs.
   h. The difficulty in obtaining science materials.
   i. The use of science readers as "the science program."
   j. In some school systems a special emphasis is placed on a particular subject throughout a school year, and if this subject is not science, it tends to rule out science.
   k. Elementary teachers have been given inappropriate subject matter in high school and college.
   l. Undue pressure of administrators or supervisors to promote science often pushes a program ahead of the interest or ability of the teachers. This is discouraging to teachers and may, in the long run, delay progress.

* Notes on panel discussion at National Council on Elementary Science at Hotel McAlpin, New York City, February 12, 1949.

[1] The panel consisted of Maurice Ahrens, Chairman; H. Emmett Brown, Katherine Hill, Beatrice Hurley, Archie MacLean, Helen B. Ross, Dorothea Wein, and Robert Wickware.

m. The lack of opportunity to see good science teaching in practice.

2. How may these blocks be removed?
   a. Let teachers begin to share their successful experiences with one another.
   b. Confer with other teachers in the same building on problems which come up; ask more experienced teachers to visit your class and make suggestions to you.
   c. Set up a simple science laboratory which other teachers may visit.
   d. Make use of science specialists or well-qualified teachers to help other teachers become familiar with science materials and methods.
   e. Administrators and teachers must provide a democratic setting in which science teaching improvement may occur.
   f. Use simple equipment when possible, but realize that a science program does not depend upon materials alone.
   g. The administration must support the science program financially and in spirit.
   h. Supply persons as resources (consultants, specialists and the like) to facilitate the science program.
   i. Make use of persons in the community to help the classroom teacher on problems with which she is not prepared to deal.
   j. Develop resources within each school so that the use of specialists will be needed less.
   k. In the training program for teachers provide problems and experiences which challenge them in their own right.
   l. Don't be so concerned with the science subject matter that the process of learning becomes obscured.
   m. Take your cues for equipment and for problems to study from the questions of children.

3. What are some suggestions for an effective in-service training program?
   a. Help the teacher to know the community in which she teaches. This may be done through actually studying the community during a workshop period or through some other scheme worked out by the teachers.
   b. Make available to teachers materials describing successful experiences of teachers who are doing a good job of science teaching. This may be done throughout the year or in an elementary science workshop.
   c. Make available to the teachers as many simple science books as possible.
   d. Encourage teachers to read the same books which are prepared for children.
   e. Bring persons responsible for pre-service training of teachers and persons responsible for in-service training of teachers together more frequently to plan ways of improving science instruction.
   f. Work out ways to help high school and college science teachers to see that science for the elementary school is not just "chemistry, physics and biology."

4. What are some suggestions for an effective pre-service training for elementary science teachers?
   a. Teachers colleges must work with schools in the communities where their teachers will teach; by having more contact with the elementary school teachers, colleges can become more sensitive to the needs of the teachers.
   b. Provide opportunities for prospective teachers to work with science experiences in their practice teaching.
   c. Give the prospective teachers opportunities to use materials and study materials which are part of the children's world.
   d. Make opportunities for prospective teachers to ask questions.
   e. Give prospective teachers experiences in finding information through all of the sources by which they will get information when they work with children.
   f. Encourage supervisors of practice teachers to make practice teaching

assignments with teachers who are doing a great deal with elementary science.

5. What are ways to help teachers improve their techniques in working with children?
   a. Help them to learn how to plan with children; suggest that they observe other teachers who do a good job of planning.
   b. Observe demonstration teaching.
   c. Organize science problems around the questions and interest of children.
   d. Keep in mind the fact that children have intelligence; give them credit for their thoughtful suggestions and follow through on the group decisions made by the children if they have given serious consideration to a problem.
   e. Provide opportunities for teachers to plan together for the betterment of the total school program.

The discussion related to techniques of working with children emphasized the necessity for being sensitive to the needs of children, of working with them in a democratic fashion, and in planning with them, insofar as possible, all of the activities in which they participate.

MINUTES OF NATIONAL COUNCIL ON ELEMENTARY SCIENCE MEETING

LOUISE ADELAIDE NEAL
Colorado State College of Education, Greeley, Colorado

THE BUSINESS meeting of the National Council on Elementary Science was called to order by the president, Rose Lammel, in the McAlpin Hotel, New York City, February 13, 1949. The minutes of the last meeting were read and approved. The treasurer's report was also read and approved. The nominating committee, H. Emmett Brown, Chairman, reported the following nominations:

President—Glenn O. Blough
Vice President—H. Emmett Brown
Secretary-Treasurer—Robert Wickware

Robert Cooper to serve on the Board of Directors for the term 1949–1954. Report of the nomination committee approved and the officers were elected.

Miss Lammel expressed thanks to Dr. Gerald S. Craig, Glenn Blough, Paul Blackwood, N.A.R.S.T., A.S.C.D., and T.E.C., for their cooperation in participating in the planning and organization of the annual meeting. Glenn Blough expressed thanks to Miss Lammel for her work in making and completing arrangements for the details of the meetings.

Miss Lammel expressed the following ideas: We should think of ways to tighten the organization and make it bigger than the present small group. We should think about next year's program as soon as this one is over. Perhaps a two day work conference should be considered. Since hotels are expensive perhaps college buildings could be used. Glenn Blough suggested meetings should be free. Mrs. MacCracken suggested that something might be given members for their money. Dr. Craig suggested two kinds of dues, sustaining and permanent membership. Suggestion was also made to have—dues and registration fee. Question was raised on the possibility of meeting with A.C.E. and A.S.C.D.

A suggestion was made to cooperate with college and secondary school science meetings and associations. There was discussion about a committee to work on publications for the Council, perhaps T.E.C. or N.Y.U. press would publish. Regional organizations were discussed. Dr. Craig suggested affiliation with N.S.T.A. Mr. Blough suggested the National Council should reach supervisors and principals. Dr. Brown suggested affiliation with several companies for materials prepared for Elementary School as they prepare them for Secondary

School. Miss Lammel suggested that the N.S.T.A. was one organization we should be heard in.

The constitution committee composed of Dr. West, Dr. Hill, Miss Scribner, Dr. Craig and Glenn Blough reported. Dr. Brown made motion to accept the constitution as revised by discussion at the meeting. The original committee was empowered to make minor changes. The motion was seconded by George Mallinson and was carried. This acceptance necessitated the election of a second vice-president. Helen MacCracken was nominated and elected.

REGIONAL RESPONSIBILITY OF TEACHERS COLLEGES IN FIELD OF SCIENCE IN-SERVICE TRAINING PROGRAM

Victor L. Crowell

State Teachers College, Trenton, New Jersey

The responsibility of the teachers college for the quality and quantity of science instruction in the elementary and secondary schools of the area served by the college does not end with the graduation of the teacher. The college must continue to render services to its graduates and to all other teachers in its area. There is evidence that teachers colleges in general have not furnished leadership in their communities commensurate with the latent potentialities. Hanor Webb in the February, 1948 issue of *Education* says, "Only a few teacher-training institutions in our nation are really leaders of educational thought; many are not even good followers of the advancing progresses of educational service." This failure of the teachers colleges to accept responsibility has led many communities and cities to operate their own in-service program. One example of this is Baltimore, Maryland, where the city has found it necessary to organize workshops and in-service courses for the public school teachers. Teachers colleges are an outgrowth of normal schools which were created to meet a popular demand. The teachers colleges are obligated to provide, in every way possible, for well educated teachers.

Some of the services which the teachers college can render are the following:

1. The college should serve as a center for professional meetings and the college faculty should attend and participate in as many of these meetings as possible.

2. The college faculty should be ready to serve as leaders and participate in teacher organizations such as state science teachers associations, if eligible to belong to these organizations.

3. College faculty members should welcome opportunities to serve as consultants for county institutes and other groups of teachers and laymen interested in the improving of science instruction.

4. The college should make its graduates and other teachers feel free to call upon them for advice and help in instructional problems. This help may take the form of conferences or correspondence.

5. The college should in so far as possible make available to the teachers in its area the resources of the library and laboratories. Animals, films, books, etc., may be loaned to teachers.

6. Bulletins and other teaching aids may be published by the college for distribution to teachers, e.g., Science in the Lanning Demonstration School.[1]

7. The college may sponsor and provide facilities for Science Fairs, exhibits, etc.

8. The college demonstration school should have science instruction of such high quality that it will serve as a stimulus for teachers who will visit the school.

9. The college should sponsor workshops

[1] Shoemaker, Lois M., and M. B. Science in the Lanning Demonstration School of the State Teachers College, Trenton, New Jersey. College Book Store, State Teachers College, Trenton, New Jersey, 1944.

for those wishing help in special areas and not desirous of working in regular courses. Example: In science are Conservation Education Workshops, Community Resource Workshops, and natural-science field centers. The February, 1948 issue of *Education* is devoted to "Workshops in Science Education." The average teacher needs help in the recognition of, and developing of competence in, using resources of the community. Teachers need help in applying scientific methods to the problems arising in the community.

10. Extension and refresher courses should be offered whenever there is a felt need for them. Because of the nature of most science courses they should be held in the college laboratories whenever possible.

11. Clinics organized for a particular school or for a school system may be sponsored by the college. Surveys of the school or community may be made by local teachers and college faculties working together and making recommendations to the administrative staff.

12. Colleges offering graduate programs have a unique opportunity for assisting teachers who wish to become master teachers. The teachers college can offer a program closely integrated with its undergraduate program and providing for further growth in the subject matter fields, such as science. As an example, plans for the State Teachers College at Trenton, New Jersey, provide that two thirds of graduate work shall be in academic fields designed to supplement the undergraduate program in science. This type of program is difficult to obtain at present in large universities.

Not all of the foregoing will be applicable in any one situation but an alert institution should endeavor to offer as many of these services as possible to the teachers in the area served by the college. The college's responsibility for good teachng in the public schools does not end when it has graduated well educated teachers.

In order to implement these services it will, in most instances, be necessary to provide increased appropriations for staff and equipment. The teaching load of most teachers college faculties today precludes the possibility of any considerable amount of writing, consulting or other work such as was suggested in this paper. Enlightened public opinion is necessary to demand and support this type of functional program. As teachers colleges grow in usefulness in the area served by them they will also grow in prestige.

OUR RIGHT-HANDED CIVILIZATION

BROTHER JOSEPH KUNTZ, S.M.
North Catholic High School, Pittsburgh, Pennsylvania

GREGOR MENDEL, the Augustinian Friar, wrote a paper describing the results of the work that he had carried on for quite a number of years in his monastery garden. At the turn of the century, his paper, after spending some forty years in oblivion, was discovered. It started a wave of interest in the little-explored field of genetics and heredity. Within a few years the limitless possibilities of heredity were brought into focus. For the next decade or two nearly all biological theorizing was given an interpretation with an *hereditary* twist. Overly-ardent followers of the Mendelian theory blamed genes and chromosomes for many of the quirks of mankind. Even the frequent and regular use of the right hand in the performance of daily routine duties was now to be explained in view of the new light shed by Mendelian laws.

Let us consider this problem of right- or left-handedness. According to the theory of the ontogenetic unfolding according to a phylogenetic pattern there should be evidence to trace this characteristic of mankind back to some early character in embryonic

development. Now the developing embryo from the egg of the domestic fowl has been studied extensively. Hundreds of thousands of partially incubated chicken eggs have passed under the scrutinizing gaze of the experimental embryologists. From this wealth of scrutiny it was concluded that certain basic unfolding patterns resulted with marked regularity. The scientists who were not blinded by their own conceits were forced to see in this regularity another thumbprint of the all-wise Creator. This basic pattern of chick embryology follows rather closely along the lines of very early mammalian development.

At about the thirty-eighth hour in the chick embryo, certain processes are initiated that result in what we may very loosely term a "right-handed" embryo. It is also a known fact that certain chemicals have a molecular structure similar to a mirror-image of their right-handed counterpart. Fertile chicken eggs have been exposed to such mirror-image or "left-handed" chemicals. Careful study of these eggs reveals the fact that after a number of hours of incubation a "left-handed" type of flexure of the developing brain is produced. This and many other forms of experimental data have been amassed to lend support to the theory of cerebral dominance, i. e., the side to which the developing brain-flexes grows earlier in embryonic life. Hence it is concluded that this side dominates the actions of the matured animal. We cannot, however, forget that spatial limitations of either the egg or the uterine cavity also play a very important role in initiating the flexure in the brain of the developing embryo.

It has been theorized therefore that too great an environmental influence may interfere with inborn right- or left-cerebral dominance and that this pressure of external circumstances will cause some minor neuro-muscular frustrations. Such things as stuttering, poor penmanship, inversion of letters in words and difficulty in translating symbolism (words) into ideas may result in a retarding of the learning processes. With these theories as a residual background we may attempt to crystalize them into the experiences of the classroom.

The standard tablet arm chair is constructed for the use of our right-handed civilization. Pity the small per cent of the left-handed individuals who are forced to twist and contort in order to adjust themselves into furniture not designed for their use. Consider the eyestrain resulting from shadows cast by light designed to be shadowless to the "right hander."

The vast majority of the products of our civilization is based upon the fact that we are a right-handed race. Our door knobs are opened with a right-handed twist. The keys of the piano that carry the melody of our songs are played with the right hand. The violin is bowed with the right hand. The standard pipe thread is a right-handed thread. Time is measured out to us on the right-handed sweep second hand of the modern clock. The photograph that does not flatter us is not the usual mirror image with which we have become so familiar. The standard pranksters have sent many an amateur mechanic off to trudge wearily, seeking for a left-handed monkey wrench.

Much of what we do and the way in which we do it is dominated by the hand that we use. To convince ourselves that a left handed person reacts differently try the following experiment. Take a dozen or more representations of famous paintings. Try it with a Christian art calendar. As you view each picture study the pathway of the unconscious movements of your eyes. After you have studied each picture go to the mirror and then view each one again. This time look at the mirror image. You will note that your eye movements follow a slightly different pattern. Certain areas of the painting may assume a greater or less importance when viewed as a "lefty" sees them. From this simple test you can realize that there is a *dextera* and a *sinistra* view of the world. Tolerance permits of both viewpoints existing simultaneously. Many more interesting observations can be made from one's own experiences. Try it.

DILEMMAS OF THE SCIENCE TEACHER

BENJAMIN C. GRUENBERG

New York, New York

1. How can we teach with conviction scientific ideas that are almost certain to be superseded?

2. How can we teach scientific ideas that are objectionable to the parents of students, or to the public at large?

3. How can we glorify the material achievements of scientific advance, while the majority of the population is still without the "common decencies"?

4. How can we urge the further advancement of science, which justifies itself so largely in terms of technological gains, when it is manifestly undermining the economic security and spiritual health of millions?

5. How can we encourage scientific scepticism without endangering the socially necessary respect for traditional order and institutions?

6. How can we relate the science that we teach to what is being done in other scientific fields, not one of which anybody can master?

7. How can we teach students to adjust themselves to a social order that is both threatened by science and dependent upon science, and that is in any case destined to change?

LAWS OF NATURE: DISCOVERED OR MAN-MADE?

C. E. MARCH

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AT THE risk of being accused of paying an undue amount of attention to trivialities and merely engaging in semantics, the writer directs attention toward a term which is rather loosely used by writers, speakers, and many others, including scientists themselves.

Much of the literature containing discourses on or about science, the scientific method, history of science, etc., invariably includes statements such as the following: "Science discovers for us the Laws of Nature"; "Newton discovered the Law of Gravitation"; "Mendel discovered the Laws of Heredity"; "Kepler discovered the Laws of Planetary Motion"; "Goldberg and Waage discovered the Law of Mass Action"; and so on ad nauseum. This writer takes issue with the use of the word *discover*.

It would seem that if science is to represent the acme of exactness, accuracy, and clarity of concepts, then the terminology and symbols used to represent and express those facts and concepts should also be as accurate as possible. Within the limits of the author's experience, the use of the term *formulate* by writers and speakers has seldom been expressed in association with "Laws of Nature." One would conclude that "Laws of Nature" already exist, have reality, and lie in wait somewhere in the Universe to be "discovered" by some personality. Scientists do not discover laws; they formulate them. In other words—and this is important—Laws of Nature are *man-made!* They are man-made statements which merely describe or state how nature or segments of nature behave. Such laws are always man-made statements based on fact, experiment, and observation, in terms of which man attempts to explain, account for, and predict the regular behavior of a system under carefully controlled conditions. Laws of Nature which express definite and close relationships are at

best only descriptions of the statistical average behavior of many cases. They are not subject to repeal in the sense that civil laws are, but they are always subject to change and modification whenever some investigator submits additional data which necessitate revisions and corrections.

Inasmuch as no human mind is perfect, no scientific law is perfect even when based on accurate and well-verified data. Those statements and generalizations which stand the test of time and experience are finally called "Laws," but are still subject to revision when additional information shows that they were inaccurate or inadequate.

Can we agree that Laws of Nature are not "discovered," but are "formulated" by man?

STATE REQUIREMENTS FOR CERTIFICATION OF TEACHERS OF ELEMENTARY SCIENCE

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INTRODUCTION

There appeared in a recent issue of *Science Education* a study[1] concerned with the preparation of teachers of elementary science. That study presented a limited amount of evidence showing that a very small proportion of the academic credit of graduates in elementary education is in the sciences. Further, the study indicated that critic teachers in the campus schools of the various teachers colleges are not trained in the field of science as much as might be desirable. Powers[2] emphasizes further this lack of training in science by citing the need for "proper alignment of the courses in elementary science of our teachers colleges and universities to our needs for teachers who can both teach science content and use the scientific method." Also, it is common knowledge that at meetings of elementary teachers, science is generally the area with which these teachers claim the least familiarity.

It might be desirable therefore to investigate further the adequacy of the training in science of elementary teachers. One of the major influences upon the subject-matter backgrounds of teachers is the requirements for certification established by the various states. It is therefore the purpose of this study to survey the requirements in science for certification to teach in elementary schools, and for certification of specialists or consultants in elementary science.

PROCEDURES

Letters were sent to the Directors of Teacher Certification, Departments of Public Instruction of all of the forty-eight states. The two following items of information were requested:

"1. Granting that all elementary teachers may teach science to some extent, what are the present requirements with respect to science courses in order to be certified fully to teach in the elementary schools in your state?

"2. Do you have any requirements for full certification of specialists or consultants in elementary science? If so, what are they?"

A second letter was sent one month later to those states which failed to respond to the first. Within two weeks after sending the second letter, replies were received from all of the forty-eight states. The information so received was analyzed and then tabulated.

Table 1 which follows lists the names of the states, the requirements in science for

[1] Mallinson, George G., "Preparing Critic Teachers to Supervise and Teach Elementary Science." *Science Education*, XXXII (October, 1948), 254-8.

[2] Powers, Leversia L., "Curriculum Planning for the Elementary Schools of Pennsylvania." *Science Education*, XXXII (October, 1948), 238-42.

TABLE 1

SCIENCE REQUIREMENTS FOR CERTIFICATION OF ELEMENTARY-SCHOOL TEACHERS AND FOR SPECIALISTS OR CONSULTANTS IN ELEMENTARY SCIENCE

State	Science Requirements for Elementary-School Teachers	Science Requirements for Specialists or Consultants in Elementary Science
Alabama	9 quarter hours of any science	None
Arizona	None	None
Arkansas		
6 yr. certificate	12 semester hours	18 hours in science
4 " "	6 " "	None
3 " "	3 " "	None
California	None	None
Colorado	None	None
Connecticut	None	None
Delaware	None	6 semester hours in science methods
Florida	None	None
Georgia	None	None
Idaho	None	None
Indiana	12 quarter hours	None
Illinois	16 semester hours (may be earned in "related" field)	36 semester hours plus 3 hours of science methods
Iowa	6 semester hours (3 nature study, 3 physical science)	None
Kansas	3 semester hours	None
Kentucky	12 semester hours	None
Louisiana	None	None
Maine	None	None
Maryland	None	None
Massachusetts	None	None
Michigan	None	None
Minnesota	None	18 quarter hours
Mississippi	None	None
Missouri	8 semester hours (covering two fields)	None
Nebraska	6 semester hours	None
Nevada	None	None
New Hampshire	None	None
Montana	None	None
New Jersey	None	None
New Mexico	12 term hours	None
New York	None	None
North Carolina	None	None
North Dakota	4 quarter hours of general science	None
Ohio	8 semester hours	M.A. in elementary science
Oklahoma	8 semester hours	None
Oregon	None	None
Pennsylvania	None	None
Rhode Island	None	None
South Carolina	None	None
South Dakota	None	None
Tennessee	9 quarter hours	None
Texas	None	None
Utah	10 quarter hours	None
Vermont	None	None
Virginia	None	None
Washington	None	None
West Virginia	12 semester hours	None
Wisconsin	None	None
Wyoming	None	None

certification of elementary-school teachers, and the requirements in science for specialists or consultants in elementary science.

CONCLUSIONS

It may be worth noting that the information gathered from the states concerned the academic credit in science which is *required* for *standard* certificates issued by states for elementary teachers and for specialists or consultants. A great number of the states indicated that temporary or provisional certificates were granted. Teachers holding these certificates usually have less science credit than do those who hold the standard certificates.

It is further worth mentioning that the teacher-training institutions in the various states do not adhere necessarily to the minimal requirements legally prescribed for science by these states. A number of these institutions require more science for graduation than is required for certification as an elementary teacher.

However, insofar as the techniques for collecting and tabulating the data are defensible, the following conclusions * seem justified:

1. In 32 states it is possible for a teacher to be certified to teach in the elementary grades without having any courses in science.

2. In the states requiring academic credit in science the required number of semester hours range from three to twelve (three term or quarter hours were considered to be equal to two semester hours.) Illinois requires sixteen semester hours but these may be in "related fields."

3. No state required that more than 10 per cent of the academic credit for graduation be in science.

4. In 43 of the 48 states it is possible to act as a specialist or consultant in the teaching of elementary science and to supervise the teaching of elementary science without having had any academic credit in science. In these states a teacher could perform such duties under certification as a general supervisor or could act in such a capacity without any certification whatsoever as a specialist or supervisor.

5. In the states requiring academic credit in science in order to act as a specialist, consultant or supervisor in elementary science, the required number of semester hours of credit ranges from six to thirty-nine. Ohio demands completion of the degree of Master of Arts with specialization in the field of subject-matter to be supervised.

SUMMARY

The results of this survey may be summarized thus. If one can assume defensibly that more adequate preparation is needed in science by elementary-school teachers and by supervisors of elementary science, it is likely that this need has arisen partly from the failure of the states to require adequate preparation in these areas. It would seem reasonable that organizations interested in the improvement of the teaching of science in elementary schools may well devote efforts toward increasing the requirements which are legally established for certification in that field.

* The data collected is valid as of June 1, 1949.

ONE HUNDRED INTERVIEWS WITH ELEMENTARY SCHOOL TEACHERS CONCERNING SCIENCE EDUCATION *

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THE INVESTIGATION described here was part of a study entitled *Some Suggestions for the Improvement of Science Education in the Elementary Schools of Massachusetts.* The study was concerned with curriculum improvement through channels related to the in-service and pre-service education of teachers. A considerable amount of curriculum revision activity has been going on in Massachusetts for several years under the leadership of the State Department of Education, and a new Curriculum Guide for the elementary schools of the State was issued in 1947. In addition to this state-wide activity, Massachusetts public school personnel have seemed to share with the country at large an increasing sense of urgency regarding science education which has led to a good deal of local curriculum revision and the introduction of new science textbooks in many schools.

The position taken in this study was that, regardless of the amount of curriculum revision activity that has been going on and the courses of study and textbooks that have been approved for use, curriculum change does not take place unless the individual teacher in each classroom changes her practices. That is to say, the objectives of education are realized only to the extent that they are realized as Miss Smith or Miss Jones teaches her class. The purpose of the study was to try to suggest ways in which the process of utilizing pertinent methods and materials from the field of science in individual classrooms might be accelerated.

The interview technique was chosen as the major method for appraising the problem of improvement of science education because it seemed that this method gave the greatest promise of revealing something about the desires, beliefs, attitudes, knowledge and skills that motivate individual teachers to do things in a particular way in their classrooms. It was believed that these were the factors that had to be changed if curriculum change was to be achieved.

The interview was planned very carefully to bring out the desired kinds of information. A trial run of ten interviews was conducted in New York for testing the questions and the techniques. Revisions were made as indicated. In final form the interview consisted of 38 questions which when administered in the actual study were asked in the same way of all subjects by the same interviewer. Responses were recorded in considerable detail.

The sample interviewed consisted of 100 teachers teaching in some one of the first six grades of 81 public schools in 29 communities in Massachusetts. Figures were available for the total distribution of elementary school teachers in the state in each of the six grades and in each of four population groups. The sample of 100 was made to conform to this same pattern of distribution. Each interview took at least one hour to give and was conducted in some quiet spot where it was possible to talk freely. The findings are presented only as the expression of 100 elementary school teachers in public schools in Massachusetts. However, to the extent that this group might be regarded as typical of similarly selected groups of teachers elsewhere, these findings may be suggestive for other localities. Space will permit only a brief discussion of certain of the large patterns that seemed to emerge as a result of a study of the tabulated data.

* Paper presented at the New York City meeting of the National Association for Research in Science Teaching, February 15, 1949. Based on the author's dissertation for the Doctor's degree at Teachers College, Columbia University.

Concerning their general plan of work and the conception of the place of science in this plan, 65 teachers felt that they worked under conditions of considerable flexibility permitting a good deal of freedom of choice. Nine more said that they had complete freedom to select for their grade according to their own best judgment. The implication was, therefore, that 74 per cent of the teachers interviewed had the freedom to utilize science materials in their work if they chose to do so.

It was found that any science materials that entered the work of these classrooms did so mainly by means of special science periods, ranging from 15 minutes to 120 minutes per week, and by correlation with other subjects. When every instance of some kind of conscious provision for science, no matter how meager, was taken into account, about half of these teachers seemed to rely on correlation and incidental teaching for science instruction.

The teachers were questioned concerning their ideas about the purpose of teaching science to children. It is not easy to articulate a statement of purpose without time to give the matter thought. It therefore seemed likely that answers to this question would reveal something about the conceptions that lay in the forefront of the teacher's attention. About one-third of the group said that they believed that interpretation of the environment was the main purpose to be served, and 23 per cent felt that satisfying curiosity was an important purpose. Seventeen per cent showed some perception of the importance of the scientific method. All other purposes were very diffusely expressed. There was no general trend in thinking about this question.

More than half of the sample said that under conditions of freedom to choose they would base science instruction on the interests of children. Further questioning to determine what was regarded as an acceptable process for identifying interests revealed that "things that come up," "incidents that occur," "things that are brought in" were mainly relied upon for identification of interests.

Questions concerned with the actual content and activities carried on during the current year (1947–48) brought out a wide variety of topics, large and small, that had been explored. Only three topics, however, were mentioned by any large number of teachers; these were: animals, mentioned by 81 per cent; plants, mentioned by 79 per cent; and weather, mentioned by 68 per cent. The sun and its relation to the earth, mentioned by 32 per cent, was next in order.

Several questions in the interview sought to go beyond what teachers had actually done to reveal something about the opinions they held concerning science content: what they thought was suitable and what they thought was unsuitable for children; what they themselves had studied, what they would like to study and what they would not like to study; what they considered themselves best equipped to teach and what they considered themselves least able to teach. Seventy-eight per cent of these teachers selected animals as the most suitable science topic for children to study. It was the number one choice on all six grade levels. Fifty-nine per cent selected electricity as the least suitable topic. A further analysis of this latter result by grade levels showed that 52 per cent of the first-grade teachers, 88 per cent of the third-grade teachers, and 71 per cent of the fifth-grade teachers made this choice.

Relative to their own training in science, the one course that more than half of these teachers had had was nature study. Since about half of the teachers in the group were over 40 years of age and received their pre-service training during the 1920's this was not at all surprising. Forty per cent of the group of 100 had had courses in biology. In contrast to this only 16 of the group said they had had courses in physical science. A few more had had courses in some single phase of physical science, but the weight of pre-service preparation among these teach-

ers was very definitely toward biology and nature study. A good deal of in-service study had gone on in the group since their original training but very little of this was found to be in courses in basic science content. Nineteen members of the group had had in-service courses in elementary science, many of them quite recently. These were typically two-semester-hour courses offered through the State Extension Service.

Questioned concerning what interest they would have in studying certain formal areas of science today, 16 said they would have no interest. Among the remaining 84, astronomy came first and physics last of seven choices. Asked which of these same subjects they would dislike having to study today, 34 of the 100 said they would have no special dislikes. Among the remaining 66 teachers, 43 chose physics or chemistry or both as the most disliked subject. Astronomy was the least disliked among seven choices. Asked to select the areas of science that they felt best prepared to teach, animals, plants, and weather headed the list in that order while the chemistry and physics areas were those they felt least prepared to deal with. When it is recalled that among the science materials actually introduced during the year 1947–48 animals, plants, and weather headed the list, it becomes evident that what the majority of these teachers are doing, what they have been prepared to do, and what they believe they are able to do seem to form a consistent pattern. An exception is noted in the case of weather in which there seemed to be a widespread interest. Few of the teachers had had any formal training in meteorology and yet some 68 per cent of them had ventured into this area with their children. No such disposition to learn with their children was evident in areas derived mainly from physics and chemistry.

The pattern of activities carried on in connection with the science topics enumerated as having been studied in 1947–48 was overwhelmingly one of reading and discussion. Discussion was mentioned by 97 and reading by 89. Forty or more mentioned demonstrations, experiments, exhibits, trips, and films as things they had done during the year. Though this was very encouraging the frequency with which these activities were used was very low as compared with the frequency with which reading and discussion were utilized.

About 62 per cent of the teachers were found to have fairly adequate textbooks and reference materials, many of them quite new. Questions concerning the use of these materials revealed that very few teachers had time to "cover the book." The general practice was to select certain units from the book. Without making any pronouncements upon the basis of selection, it is evident from the findings that the mere possession and use of books containing a wide range of materials for a particular grade does not of itself assure a science program of adequate scope. Furthermore, the motivations that lead a teacher to make particular selections from a text book or a course of study are here regarded as being crucial in determining the actual curriculum that results in a particular grade as a result of using certain books.

The two obstacles most prominently mentioned as standing in the way of doing more about science in their classrooms were lack of time and lack of equipment. Time always seems to be mentioned as a barrier to change in the early stages of any innovation. It is unlikely that such problems can be solved by mere manipulation of time. The crux of the situation would appear to lie rather in the building up of faith in the new procedure. When the conviction of what is important has changed, the problem of time seems to adjust itself.

Twenty-eight teachers mentioned lack of equipment as a major obstacle to science teaching but several parts of the interview revealed that questions related to equipment often brought answeres that were full of rationalization. Very few classrooms were found to possess any science equipment supplied by the school system. Whatever else

may be said concerning this problem, the fact remains that the schools in this study were not yet providing science supplies as a regular function. However, 51 teachers expressed no positive conviction that they could not get science supplies if they asked for them. For more than half of the group, the viewpoint was probably best summed up in the words of one teacher when she said "We can order anything we want. We just don't seem to get started asking for that sort of thing." Another question of interest in connection with equipment came much later in the interview when teachers were asked what they would buy if money were immediately available for anything they would like to have for promoting science education in their classrooms. Fifty-six said they would buy books, magazines, films or slides. Only 23 said they would buy equipment for experiments and out of these only nine were able to enumerate any specific equipment. Clearly, the conviction that equipment is necessary for science teaching was held as a generalization by many of these teachers, but the specific equipment useful for teaching children seemed to be very imperfectly understood.

Inasmuch as it was believed that many adults experience certain areas of reservation and conflict with regard to some of the teachings of science, an effort was made to gain some information as to the extent of such reservations among these teachers. Questions along these lines revealed that the great majority of teachers in this group regarded sex education, the origin and history of the earth, and the origin and evolution of life as exceedingly delicate areas to be approached in the school and indicated that they would usually avoid them. When asked whether they found it personally difficult to reconcile science facts with their religious convictions, one-third of the teachers said that they did.

As a result of the appraisal of the problem partially outlined in the foregoing discussion, four areas of need among teachers were identified to be constantly held in mind in all recommendations made for pre-service and in-service education of teachers. These needs are not unfamiliar: the need for deeper insight; the need for skill; the need for a body of interesting, non-technical, factual information; the need for reduction of emotional tension and conflicts relative to science.

In the study of which this investigation was a part, suggestions consistent with the findings were made on a state-wide basis for Massachusetts, directed particularly to the channels available to the State Department of Education. It has been said that the most hopeful approach to the problem of achieving new goals lies in first of all understanding thoroughly where we are, and then planning how we get from here to there. If that is true, these findings may also be suggestive for groups of teachers attacking their own problems of education while in service, and for professional personnel engaged in the pre-service education of teachers. Probably the most pressing need indicated by this investigation is the need for professional personnel to re-examine their procedures, and to be more ingenious, more resourceful, and more realistic in devising ways to prepare teachers for their responsibilities in science education.

DO WE EXPECT TOO MUCH OR TOO LITTLE OF CHILDREN FROM THEIR EXPERIENCES IN SCIENCE?

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A POPULAR wave of meetings centering around such topics as, "How can we improve science instruction?" seems to be in vogue. This is a healthy sign which indicates that we are making progress but shows at the same time that we are conscious of our short-comings. In discussions of this kind we need to keep in mind the abilities of the children: in what ways are we expecting too much of them and in what ways too little?

Of course, no one can answer this question in definite terms. The answers will vary with the backgrounds of the teaching personnel involved, with the different types of curriculum organization and administration and with various other factors. However, from an examination of the topic, we can to some extent evaluate our procedures and thus work toward improving techniques and making our teaching more effective.

Before we proceed, let us examine briefly one basic assumption upon which we have worked in the past. We have assumed that children could achieve, in some degree, some of the desirable goals we have set up for them. We no longer have to work upon an assumption along these lines. A recent study* has proved what we had long hoped and believed to be true. Certain goals in elementary school science can be realized by children. Responsibility and cooperation, use of initiative, application of experience, and the use of skills were those objectives responded to most often by children participating in the study. The following objectives were also shown to be realized in varying degrees: recognition and identification of natural phenomena, the tendency to use inquiry as a means of learning, the recognition of cause and effect relationships, the ability to draw conclusions, recognition of the achievements of thinking, open-mindedness, and the application of experiences.

Since these desirable goals can be achieved, in varying degrees, it places an even greater responsibility upon us than we have previously assumed. In what ways are we expecting too much or too little of children?

Too Little

1. We expect too little of children in their ability to think for themselves. Children can and do think on their own levels, if given the opportunity. Watch groups of children being taught science and note how many times the answers are supplied by the teacher when the answers are not given immediately. Either we accept only in print the idea that children can think or we organize and time our teaching so that little opportunity is allowed for thinking. We still speak of units on magnets, birds, and insects. We develop our courses about topics such as water, machines, and plants. Much of our teaching is still based on the old object-lesson method. Would it not be better, by the very nature of its organization, to develop our work *about simple questions* which are designed primarily to stimulate thinking? Why does it rain? What causes day and night? How do plants make food? are examples. Might not this approach call for a reorganization of our work and allow more opportunities for thinking?

2. We expect too little of children in drawing their own conclusions after an appropriate set of experiences. It has been shown that they can draw conclusions. We forget that "telling is not teaching" and supply the answers ready made or we often

* Hill, Katherine Elizabeth. Children's Contributions to Science Discussions. New York: Bureau of Publications, Teachers College, Columbia University, 1947. 96 pages.

prompt them, supplying a word here and there, until we have wrung from them the answers we want. True, their conclusions may not be the same as ours, but they do represent honest attempts at thinking on the part of the children and reveal to us places where we need to further clarify our work. Also other opportunities for drawing conclusions are now fortified by further evidence.

3. We do not give the children enough to do. There are far too many teacher-demonstrations, the teacher doing all the manipulation and thus most of the learning. There is no substitute quite as good as learning from first-hand experience. We should expect more of children in performing simple experiments and making class demonstrations. Often such experimentation leads to clever and original thinking on the part of the children.

4. We expect too little in using initiative. Experience shows that they can help plan and carry much of their work to a satisfactory conclusion if they are given the opportunity. We give them too little voice in planning, investigating, and performing experiments which they wish to try. Such statements as "Now, children, what would you like to do today?," do not provide the right kind of opportunity for using initiative. Carefully directed teacher-pupil planning is a better answer. Of course, this latter method is far more difficult than many others and requires a superior kind of skill on the part of the teacher, but it is well worth trying. Finally, children can help set up their own problems rather than follow sets of ready-made problems which are all too often adult in wording and organization.

5. We do not expect enough of children in identifying everyday-life principles they see in action with what they have learned in the classroom. For example, suppose we are studying why a boat floats. Such directives as, "Tell something about floating that has *happened to you*," or "Why do some kinds of soap float?," may aid in identifying the principle under discussion with actual experiences. A principle has really not been learned until we teach it through the point of application.

6. We do not expect enough of children as a result of experiments and other attempts which fail. Too often, we hastily repeat the experience with a mumbled apology for its failure. Why not capitalize upon the failure by having the children analyze it step by step, examining carefully materials and methods, then propose other solutions, and repeat the experience? In real life many of our own efforts end in failure. How much it might have helped us if we had been taught early to capitalize upon our failures.

7. We do not expect enough of children in helping to evaluate the outcomes of their work. All too often we evaluate from the adult standpoint alone. For example, a second grade teacher felt that a garden project had been a failure because several long-term goals which she had set up were apparently not realized. The children enjoyed growing a few plants and seemed to be proud of a few simple ideas they had gained. The project was a success to them.

Too Much

1. The problems we plan for children should be of such a nature that they can feel a definite sense of achievement from their experiences. We expect children to be conscious of broad adult themes which cover too much ground and last too long. One school system expects its sixth graders to concentrate upon conservation during the entire year. Even we, as adults, tend not to concentrate upon a single phase of living to the exclusion of others over long periods of time. Surely, to do this is expecting too much of children. The large topic of conservation broken down into smaller problems and interwoven with other work in science might prove more successful.

2. We expect children to get ideas from the printed page too soon. We expect them

to grasp abstract ideas by reading about them when the mechanics of reading makes them lose the thought of the idea that is being developed. We would profit in beginning the ideas by doing something such as simple experiments or field trips. When the children have gained working ideas and sufficient vocabulary then use books to verify, clarify, and extend the ideas. As an example, delay teaching the causes of seasons until the later elementary grades. By then abstract ideas are likely to have meaning.

3. We expect children to generalize upon the basis of too few experiences. For example, we expect smaller children to generalize that air occupies space from blowing up a balloon. A better plan would be to repeat the experiment several times, let them perform other experiments involving the same idea but done in a different way and with different materials. Thus, we would provide more adequate experiences as a basis for drawing conclusions.

4. We present experiments before children have the prerequisite ideas necessary for their interpretation. For example, we perform experiments to show that a given volume of warm air is lighter than the same volume of cold air before they understand that air is something, that it has weight and occupies space. According to the writer's opinion this is a major reason why experiments often fail to "go across". A simple examination and presentation of prerequisite ideas should make experiments more direct and easily understandable.

5. We expect children to transfer their thinking from simple models to realities too soon. Common examples are, "This ball is the earth," or "This is a clay model of a part of the moon's surface". Adults often have difficulty in thinking in terms of a spherical earth and some adults are amazed at a glance at the moon's surface through a telescope or from good photographs. Try to delay the transfer of such thinking until the children's discussions indicate that they are ready for it.

6. We often give children the impression that once a piece of work has been completed that there is nothing more for them to learn about it. It is expecting too much for them to realize that this is merely an acquaintance with the material involved. It reminds one of the children who in beginning plant study in the sixth grade exclaimed, "Plants again! We know all about them, we had them in the fourth and fifth grades, too."

7. We talk about and show pictures of other objects from the environment and feel that we have completed the job. It is expecting too much of children to think that their ideas of natural phenomena can mean much until we have made as much use as possible of nature materials in relation to the environment. For example, in one class the children saw pictures and read and talked about certain kinds of ferns until the group was all excited over them, yet several excellent specimens were passed by on a field trip without any comment from the teacher. Another teacher taught about rock layers from an excellent model but failed to call attention to a road-bed cut a short distance from the school where an excellent example was to be seen.

Such evaluations as the above do not mean that we have lost faith in science teaching. On the contrary, they indicate that elementary school science is coming of age and that we are willing to take an honest look at our teaching with a view to its continuing improvement.

ABSTRACTS

MALLINSON, GEORGE GREISEN. "Motion Pictures for Elementary Science." *School Science and Mathematics.* 49:383–391. May, 1949.

The author reports a rating study of certain films suitable for use in elementary science. Brief descriptions are given regarding a number of films.

MALLINSON, GEORGE GREISEN. "An Investigation of the Subject-Matter Backgrounds of Student Teachers in Science." *Reprint from School Science and Mathematics,* April, 1949.

This article describes the techniques used in constructing a test for student teachers in science and the statistical results obtained from giving the test to science student teachers in five state teachers colleges and one university school of education. The test consisted of two parts—a short-answer and an essay part, each part having a total of 100 points. Each of four areas was given equal weighting: earth science, biology, physics, and chemistry. The study showed a definite unbalance of training in science among the students tested.

JOSEPH, ALEXANDER. "Projects in Elementary School Science." *The Science Classroom* 28: 1, 4. September, 1948.

Projects described relate to soil conservation, work in the greenhouse, zoo activities, fat conservation, pins, needles and thread.

STOLLBERG, ROBERT. "Electric Circuits." *The Instructor* 58:52 January, 1949.

This brief illustrated article discusses electrical conductors, a simple circuit, and a two-way telegraph set.

STOLLBERG, ROBERT. "Experiments with Carbon Dioxide." *The Instructor* 58:54 and 50. February and March, 1949.

This teacher unit describes some experiments with carbon dioxide including dry ice.

STOLLBERG, ROBERT. "Experiments with Plants." *The Instructor* 58:34 April, 1949.

This article describes a series of experiments to show that growing plants give off water and oxygen, and that plants do not make food in darkness.

STOLLBERG, ROBERT. "The Wind." *The Instructor* 58:56 June, 1949.

A number of experiments describing the force of moving air.

O'BRIEN, BLANCHE H. "An Elementary Science Fair." *The Instructor* 58:17, 67. January, 1949.

This brief article appraises the values of an elementary science fair and the teachers part in such a fair.

FORD, HELEN CROSS. "Activities and a Test on Sound." *The Instructor* 58:25, 66. January, 1949.

A short unit for the upper grades that includes six activities, a test, and key.

KLEIN, GRACE. "A Unit on Wild Animals." *The Instructor* 58:24, 76, 79. February, 1949.

This illustrated middle grade science unit lists objectives, procedure, activities, classes of animals, a study outline, outcomes, and riddle stories.

MILLS, GRACE EVELYN. "Our Usefull Trees." *The Instructor* 58:30, 69, 77. March, 1949.

This is a short play suitable for the middle and upper grades.

STEVENS, GERTRUDE F. "The Earth and the Globe." *The Instructor* 58:24, 73. March, 1949.

This is a science unit for the middle grades. Teacher objectives, pupil aims, subject matter content, integrations and culmination are included in the outline.

DAVIS, MARY. "Bird Study in Third Grade." *The Instructor.* 58:25, 90. April, 1949.

This article explains how bird study may be made a vital unit in the third grade.

EVANS, MARY. "Wild Animals and the Circus." *The Instructor* 58:14, 67–68. June, 1949.

This is an elementary science unit for the primary grades that provides for much activity.

KOREY, RUTH ANNE. "Finding Out About Wild Flowers." *The Instructor* 58:25, 71. June, 1949.

This is a unit for middle and upper grades that provides for field trips.

PALMER, E. LAURENCE. "Let's Measure Things." *Cornell Rural School Leaflet* 42:3–63, September, 1948.

This is a teacher's number. Topics considered include: measuring space; measurement of interest to trappers, fishermen and hunters; measuring areas, volume, time, weight, number, position, temperature, humidity, and speed.

PALMER, E. LAURENCE. "Lawn Laboratories." *Cornell Rural School Leaflet.* 42:3–32. Fall, 1948.

Various aspects of lawns are considered such as light on the lawn, general appearance, temperatures, maintaining lawns, lawn plants, grasses, weeds, insects, and birds.

PALMER, E. LAURENCE. "Wood." *Cornell Rural School Leaflet.* 42:3–32. Winter 1948–49.

Kinds, properties, curing, uses and other characteristics of wood are considered. A useful, compact table gives much information about twenty-four common trees.

PALMER, E. LAURENCE. "Some Common Shell-Bearers and Their Kin." *Cornell Rural School Leaflet*. 42:3–32. Spring, 1949.

Fresh-water clams, snails, and their close relatives, the slugs are considered in this leaflet. Life histories, habits, foods, and economic importance are discussed. There are four plates and a summarization table.

SYMPOSIUM. "Children Need Nurture; Children Need Continuity; Children Need Work and Play; Children Need Guidance; Children Need Adventure; Children Need Beauty; Children Need Understanding; Children Need to Identify." *Childhood Education*. 25:September, November, December, 1948; January, February, March, April, and May, 1949.

The general theme of Volume 25 of *Childhood Education* was the various needs of children. Each issue through articles by numerous individuals developed one significant aspect of those needs.

ANONYMOUS. "Fossils: Keys to the Earth's Past." *Junior Natural History Magazine* 13:4–7–12, September, 1948.

Without a knowledge of fossils man's understanding of the earth and its creatures would be quite limited. This illustrated article explains why all plants and animals did not become fossils, how fossils are recovered, and how their story is revealed.

ANONYMOUS. "That Spider in the Garden." *Junior Natural History Magazine*. 13:4–6, 12, October, 1948.

Spiders are among those animals that have acquired a bad name without deserving it. So many people are "deathly afraid of spiders." The one exception is the black widow. The illustrated article gives much interesting information about the habits of spiders.

ANONYMOUS. "The Foods That People Eat." *Junior Natural History Magazine*. 13:4–6, 12. November, 1948.

Everybody to his own taste seems to be the rule in people's eating. What queer foods some people eat! Mutton and fat for the Mongolians; seal, walrus, fish, and whale for the Eskimos; ants, snakes, and bugs for some Africans; insects for the Boro Indians of the Amazon; milkweed plants for the Sioux and Zuni Indians; sea worms for some peoples of the South Seas; and grasshoppers for the Aztec Indians.

ANONYMOUS. "Winning the Winter." *Junior Natural History Magazine*. 13:4–6, 12. December, 1948.

Winter is the common enemy of the weak and the strong. Animals meet this enemy in various ways: hibernating, migrating, by winter sleeping, and some live on the plants and animals at hand.

ANONYMOUS. "Mighty Midgets of the Bird World." *Junior Natural History Magazine*. 13:4–6. January, 1949.

Hummingbirds are the midgets of the bird world. They are noted for their beauty, their amazing fearlessness, their ability to fly backwards, and their power to "stand still" in air. Their food consists of nectar, insects, spiders, ants, and so on.

ANONYMOUS. "Hamsters: Modern Pets." *Junior Natural History Magazine*. 13:11–12. February, 1949.

The first hamsters were imported into the United States from their native Syria in 1938. Since then they have grown rapidly as favorites for pets and as laboratory test animals. They spend only two months in growing up and their entire life cycle can be studied in one semester. They live to be about three years old. Children like them as pets because of their small size (five to six inches in length and a quarter of a pound in weight) their lustrous beauty, easy handling, their gentle friendliness, and freedom from odors.

ANONYMOUS. "Born to Travel." *Junior Natural History Magazine*. 14:4–6. March, 1949.

Much of the life history of eels remains a mystery but after centuries of superstitions regarding them, many important facts have been established. After spending their adult lives in rivers and streams of North America and Europe the adults return to the Sargasso Sea to spawn and die. In some way the young of North American parents return to their native streams and those of European parentage return to their original homes.

ANONYMOUS. "They Grew Their Own Armor." *Junior Natural History Magazine*. 14:4–7. April, 1949.

This is an illustrated article on dinosaurs, especially those that developed armor which served as a natural protection.

ANONYMOUS. "Snakes That Cause Trouble." *Junior Natural History Magazine*. 14:4–6, 16. May, 1949.

This is an illustrated article describing some of the poisonous snakes of the world: the water-moccasin, the copperhead, rattle snakes, the bush-masters, and the cobra.

ANONYMOUS. "Grasshoppers—Friends or Foes?" *Junior Natural History Magazine*. 14:4–6. June, 1949.

Grasshoppers are usually thought of as enemies because of the many grasshopper "plagues" and the millions of dollars of damage they cause each year. But they also serve as food for frogs, toads, salamanders, snakes, lizards, birds, and even man himself (some Indians, Japan, and Africa)!

Symposium. "Power; Aviation; and Chemistry at Work." *Building America.*

The above are three titles of units published by The Association for Supervision and Curriculum Development of the National Education Association. These units would serve excellently for elementary science or junior high school science source materials. Numerous photographs and diagrams supplement the authoritative textual material which has been brought completely up to date. References are given for each unit. The illustrations are especially good and effective. A number of earlier units are available.

Joseph, Alexander. "The Changing Scene in Science Education." *The Science Classroom.* 28:1, 4. October, 1948.

Physical science or fused courses in science and laboratory work have about held their own since the close of the war. Science fairs have increased in popularity and the science packets of NSTA have proved quite popular. A functional approach to science teaching is more in evidence as well as an increased interest in consumer education.

Subarsky, Zachariah. "What Is Science Talent?" *Reprint from Scientific Monthly* Volume 66, May, 1948.

The author discusses the endowments and predilections essential in the development of a scientist. Four fundamental ingredients are listed: (1) a high degree of innate curiosity, (2) the ability to spot or detect an incongruity or inconsistency when confronted by facts—the power to develop by intuition as it were, tentative explanations than can be tested by experimentation or by wider observation, and (3) the ability and predilection to think in quantitative terms, and (4) manual dexterity, manipulative ability, mechanical-mindedness, or whatever other name such an ability may be called.

Stickler, W. Hugh. "Some Practical Problems in Teaching Science in General Education." *Quarterly Journal of the Florida Academy of Science.* 10:67–71. June, 1948.

Science courses in general education are having particular difficulty because: (1) the problem of the curriculum itself—courses contain a poorly selected body of material in which the teacher is informed and interested rather than science problems which are pertinent and meaningful in the lives of the students; (2) the problem of the teaching staff—science courses in general education are difficult to teach—more difficult to teach than even advanced "straight line" courses; (3) place of laboratory in science in general education has not been thoroughly thought through, and (4) science textual materials for general education should be more readable.

Washton, Nathan S. "A Survey of Science Courses for General Education in Colleges. *Association of American Colleges Bulletin* 34: 285–294. October, 1948.

This study reports the results of a questionnaire study made in 1948. Four hundred twenty-three of 500 colleges replied. Forty-six per cent of the colleges replying do not offer any science survey courses. The typical course is offered for two semesters with six credits. It is a non-laboratory course which uses demonstrations and other visual aids. The course is primarily lecture with little class discussion.

BOOK REVIEWS

Lockwood, Elizabeth A. *Activities in Nutrition Education for Kindergarten through Sixth Grade; Goals for Nutrition Education for Elementary and Secondary Education.* Boston 15 (695 Huntington Avenue): Department of Nutrition, Harvard School of Public Health. 44 p.

The Activities bulletin describes a research study carried out during the school year of 1946–47 in several of the public elementary schools of Newton, Massachusetts. Each grade level is considered specifically. Elementary teachers and school officials can obtain much practical information from the bulletin and are urged to initiate similar programs in their own school.

The pamphlet on goals is described as a "road map" to better health. Specific goals are listed on a three grade-level (kindergarten through grade twelve) in four parallel columns.

C. M. P.

Blough, Glenn O., and Blackwood, Paul E. *Science Teaching in Rural and Small Town Schools.* Washington: Superintendent of Documents, U. S. Government Printing Office, 1949. 55 p. $0.20.

The study of science should become an essential part of the curriculum of every elementary rural and small town school. Such a publication as this fulfills a long-time need and should prove to be of much practical help for all rural and small town teachers. The authors are well known in the field of elementary school science. Their many years of experience and study served as a background in the development of this Federal Security Agency publication. Teachers of science in elementary schools in larger towns and cities will find the information equally useful. In fact, practically every elementary teacher should have a copy of this publication.

The aims, values, and philosophy of elementary

science are first discussed. Examples of incidental and planned experiences are given. Then follow chapters on Science to Meet Children's Needs and Interests, Resources 'Across the Way and Down the Road,' How Children Learn Science, Helps for the Classroom Teacher, The Materials of Instruction, and Bibliography.

C. M. P.

BLOUGH, GLENN O., AND BLACKWOOD, PAUL E. *Teaching Elementary Science.* Washington 25, D. C.: Superintendent of Documents, United States Government Printing Office, 1948. 40 p. $0.15.

Teaching Elementary Science is an unusually fine publication for elementary teachers. They will find many practical suggestions for doing a more effective job of teaching elementary science, whether they are starting to teach elementary science for the first time or have had years of experience. After preliminary attention to the philosophy and purpose of teaching elementary science the guide discusses the science teacher, how children learn science, illustrating a method of teaching, science resources at your door, and materials and apparatus. A selected bibliography is included.

It would be a fortunate circumstance indeed if every elementary teacher, elementary principal, and school superintendent could have a copy of this guide. Mr. Blough is Specialist in Elementary Science and Mr. Blackwood is Assistant Specialist in Elementary Science, both in the U. S. Office of Education.

C. M. P.

HAUPT, GEORGE W. (Chairman). *Safety Thru Elementary Science.* Washington, D. C.: National Education Association, 1949. 40 p. $0.50.

The purpose of this bulletin is to help teachers of the upper elementary grades make safety an integral part of their science instruction. Scientific principles are suggested which can be explained to children in terms of hazards involved and desirable practices. For each science understanding, activities are proposed which are designed to make the principles meaningful.

The material was prepared by a joint committee of the National Commission on Safety Education and the National Science Teachers Association of the National Education Association.

C. M. P.

MALLINSON, GEORGE G. *Sponsoring the Science Club.* Cedar Falls, Iowa: Educational Service, Iowa State Teachers College, 1948. 18 p. $0.15.

Science teachers actively or prospectively sponsoring science clubs will find much practical information in this bulletin. Its stated four-fold purpose: (1) to list the various objectives for which science clubs may be organized, (2) to suggest methods of organization, (3) to suggest various types of science clubs and activities, and (4) to present various references, periodicals, and source materials.

C. M. P.

MALLINSON, GEORGE G., AND GJERDE WALDEMAR. *The Use of Films in High School Science.* Cedar Falls, Iowa: Educational Service, Iowa State Teachers College, 1948. 22 p. $0.15.

This bulletin indicates procedures for effectively using films in high school science and evaluates specific films in various areas of teaching science.

C. M. P.

SCIENCE CLUBS OF AMERICA. *Science Clubs of America Sponsor Handbook.* Washington, D. C. Science Service, 1948. 98 pp. $0.10.

This is the annual handbook of Science Clubs of America. Few publications contain so much for so little. Contents include: how to organize your science club, activities for your science club, projects for your science club to undertake, co-projects for your club, how to get club publicity, affiliated groups in various states, science service aids for science clubs, how to conduct your science fair, eighth science talent search, recommended books for science clubs, free and low cost materials for science clubs, and where science clubs are located.

C. M. P.

HUDSPETH, JACK, AND HUDSPETH, FRANCES. *Handbook for Teachers of Elementary Science.* Austin, Texas: The Steck Company, 1947. 77 p.

Here is an excellent book for all teachers of science in the elementary grades whether or not the teacher is using the Hudspeth workbooks. There are numerous illustrations and the approach is practical.

After discussing the need for science in the elementary grades, major science concepts, aims, objectives, content, qualifications for teachers and methods of teaching science, the handbook discusses how to use current events, correlation of elementary science with other subjects, the elementary science classroom, necessary science teaching materials, care of science materials, some common laboratory techniques, maintaining a balanced aquarium, maintaining terraria in the room, making use of a small microscope, using visual aids, reference materials for teachers, and sources of supplies.

C. M. P.

HUDSPETH, JACK, AND STEEL, MARY. *The World About Us; Life on Our Earth; Teacher's Manual for Life on Our Earth; Teacher's Manual for the World About Us.* Austin, Texas: The Stock Company, 1948, 1948. 112 p. 128 p. 180 p. 126 p.

The above titles are a part of the Steck Science Series of Elementary science workbooks for pupils. *The World About Us* is intended for the fourth grade and includes twelve topics: the world of plants, the air about us, the world we

live on, protecting themselves, growing up, the ground beneath us, making work easy, the sky at night, and living together. Blanks to fill, activities to carry out, experiments to do follow the introductory descriptive material about each topic. Numerous illustrations add to the book's usefulness.

Life on Our Earth is for the fifth grade and the general plan is similar to that described above. The units are: how insects help and harm us, water and its uses, getting ready for winter, the air around the earth, how people use fire, understanding our weather, being healthy by being wise, the earth's neighbors, avoiding accidents by being wise, our changing earth, how plants live, and water life.

The *Teacher's Manuals for Life on Our Earth* and *The World About Us* are quite comprehensive, and replete with information and suggestions for using the workbook. The Hudspeth workbooks have been quite popular as is attested by their wide usage. All teachers teaching elementary science will find much valuable material in the four titles listed above.

C. M. P.

Zim, Herbert S. *Homing Pigeons.* New York: William Morrow and Company, 1949. 63 p. $2.00.

This is another junior book by a well known science writer. Many readers will recall his earlier *Elephants, Rabbits,* and *Goldfish,* and other books. This book is in a similar vein. It is based on one of America's most popular hobbies —the raising, flying, and racing of homing pigeons. There are numerous black and white illustrations by James Gordon Irving.

This is an excellent supplementary book in the study of birds and will especially delight any boy or girl who has been or is interested in homing pigeons.

C. M. P.

Keeler, Katherine Southwick. *Summer Comes to Meadow Brook Farm; Autumn Comes to Meadow Brook Farm.* New York: Thomas Nelson and Sons, 1948. 40 p. each. $2.00 each.

These two books are Mrs. Keeler's ninth and tenth books for children, and the second and third in the Meadow Brook Farm Series. *Spring Comes to Meadow Brook Farm* was published earlier and *Winter Comes to Meadow Brook Farm* is in preparation. Among Mrs. Keeler's earlier delightful books for children are: *Apple Rush, Dog Days, Children's Zoo, Today with Tommy, Today with Dede, A Party for Hoppy,* and *Bronco Bill's Circus.*

Characters in the Meadow Brook series remain the same: Farmer Allen; Ben, his helper; Mrs. Allen; Peter and Philip, the twins; Ronnie and his sister, Ruth; Pipsy, the duckling; Twaddle, the duck; and Dutchess, the calf. Here at Meadow Brook Farm are found all the usual animals found on the farm and the varied numerous, interesting activities associated with farm life. What fun and good times were had by all. The children learned that work could be fun, too.

Both farm and city boys and girls will enjoy the books. The illustrations, in color, are by Mrs. Keeler.

C. M. P.

Parker, Bertha Morris. *Matter and Molecules; The Science of Building; How We Are Built.* Evanston, Illinois: Row, Peterson and Company, 1947. 36 p. each.

These three titles are a part of the *Basic Science Education Series.* The booklets are intended for the junior high school level. The textual material is very readable and is technically accurate. The material in *Matter and Molecules* was checked for scientific accuracy by Byron F. Swan of the Laboratory School of the University of Chicago. Dr. M. Elizabeth Downing, M.D. is co-author of *How We Are Built.*

Junior high school pupils, elementary science teachers, and general science teachers will find these booklets a source of interesting, valuable supplementary information.

C. M. P.

Parker, Bertha Morris. *Spring Is Here; Summer Is Here; Fall Is Here; Winter Is Here.* Evanston, Illinois: Row, Peterson and Company, 1948. 36 p. each.

These four titles are unusually attractive books suitable for first and second graders. They are part of the *Basic Science Education Series.* Especial attention has been paid to the difficulty of the reading content.

The author is a well known elementary science writer and teaches in the Laboratory School of the University of Chicago. Eye-catching, interesting illustrations in color are by Frederick E. Seyforth.

The reviewer recommends this series as one of the finest primary level elementary science readers. Children will really appreciate having such nice books to read. A picture dictionary of common terms is found on the inside covers.

C. M. P.

Warner, Gertrude Chandler. *Star Stories.* Boston: The Pilgrim Press, 1947. 64 p. $1.25.

This is a revised edition of a very popular juvenile book. The story has been completely rewritten and illustrated. Emphasis is laid upon the identification of the stars, so that boys and girls may easily find them in the sky at all times when they are visible. Clear diagrams of nineteen constellations add much to the usefulness of the book. Below each diagram is a line for the child to fill out. "I found this on ....." It is a delightful beginners book for the study of stars of about upper intermediate grade level. Better try it out some of you teachers of elementary science!

C. M. P.

LEWELLEN, JOHN. *You and Atomic Energy and Its Wonderful Uses.* Chicago: Children's Press, Inc., 1949. Unpaged. $1.50.

This book probably explains atomic energy about as simply as the story can be told. It is intended for the sixth grade up. Few writers have attempted to write such a book at as low a grade level. It seems to the reviewer that while the better sixth grade students may read the book with understanding, many junior high school students will find the book not too easy. One can never be certain whether certain theoretical scientific principles are actually understood even when they are stated in very simple terms. Yet it is quite true many students in the sixth to ninth grade can read the book with understanding and interest.

On the other hand the writer is to be commended for a good job of explaining simply a very difficult scientific subject. It would serve as a good junior high school reference book. Elementary teachers will find it a useful reference.

The scientific facts have been checked by Dr. Glenn T. Seaborg, nuclear chemist of the University of California and co-discoverer of plutonium. Illustrations are by Lois Fisher. At the back there is a rather long list of explanation of terms for better understanding of daily references to the new uses being developed for atomic energy.

C. M. P.

LOGAN, ROBERT BRIGGS. *The Blue Book of Dogs; The Red Book of Dogs.* Racine, Wisconsin: Whitman Publishing Company. 62 p. each. $0.25 each with a minimum packaging of 12 copies each.

These are pocket-size guide books. Brief descriptions are given of many different breeds of dogs. Each book has 57 full color illustrations of the different breeds painted by Ole Larsen.

C. M. P.

GODFREY, JR., JOE. *Fresh Water Fish; Salt Water Fish.* Racine, Wisconsin: Whitman Publishing Company. 62 p. each. $0.25 each with a minimum packaging of 12 copies each.

This pocket-size guide book describes many of the common fresh-water and salt-water fish. In the former are such fish as bass, bluegill, catfish, crappie, grayling, perch, pickerel, pike, salmon, and trout. Among the saltwater fish are: bass, cod, flounder, haddock, halibut, mackeral, snapper, tuna, and weakfish. Illustrations are in color by Gordon Ertz.

C. M. P.

WEBBER, IRMA E. *Bits That Grow Big.* New York: William R. Scott, Inc., Publisher, 1949. 64 p. $1.50.

This is a story of plant reproduction. Many readers will recall the author's earlier books about plants: *Up Above and Down Below, Travelers All,* and *Anywhere in the World.*

A number of experiments for the pupils and teacher to do are described. A list of things needed for the experiments is given at the beginning of the book. Many interesting illustrations in color add to the attractiveness of the book.

In difficulty the book is probably best suited for the intermediate grade level. This is recommended as an excellent elementary science book.

C. M. P.

LUM, PETER. *The Stars in Our Heavens.* New York (41 Washington Square): Pantheon Books, Inc., 1948. 245 p. $3.75.

Thinking man has always wondered, even from remotest time, about the starry patterns found in the sky. Practically all peoples saw images and held certain beliefs about what they saw. The author relates these stories in a most readable style. Many presently known facts and hypotheses are given along with these stories. There are twenty-four full page illustrations and diagrams of various configurations in the sky. Knowing these configurations and the stories other peoples have associated with them adds much to one's enjoyment and appreciation of the starry universe that is nightly visible. This is an excellent book for all amateurs interested in stars and their legends. Elementary teachers and junior high school science teachers will find the book both interesting and practical.

C. M. P.

EVERETT, T. H. *A Guide to Field Flowers; A Guide to Garden Flowers; A Guide to Woodland Flowers.* Racine, Wisconsin: Whitman Publishing Company. 60 p. each. $0.25 each with minimum packaging of 12 copies each.

These pocket-sized guides are by T. H. Everett, Horticulturist for the New York Botanical Gardens. Illustrations in full color are by Rudolf Freund. Elementary science and biology teachers and high school students will find these guides most useful.

C. M. P.

ASHBROOK, FRANK G. *The Blue Book of Birds of North America. The Green Book of Birds of North America. The Red Book of Birds of America. The Yellow Book of Birds of America.* Racine, Wisconsin: Whitman Publishing Company, 1946. 60 p. each. $0.25 each with minimum packaging of 12 copies each.

These are handy pocket size books especially suitable for carrying on field trips. Description and interesting facts are given about various birds. Pictures in color are by Paul Moller and each picture represents a male of the species.

Blue Book lists Jays, Larks, Orioles, Grackles, Finches, Sparrows, Grosbeaks, Blackbirds, Buntings and so on; *Green Book* lists Warblers, Chickadees, Nuthatches, Tanagers, Thrushes, Waxwings, Vireos and so on; *Red Book* lists Gulls, Terns, Ducks, Hawks, Eagles, Owls, Herons and so on; and *Yellow Book* lists Swallows, Wrens, Humming birds, Flycatchers, Woodpeckers, Quail and so on.

The books are especially handy for elementary science and biology teachers and high school students.

C. M. P.

Cunningham, Virginia. *One Hundred Animal Stories.* Racine, Wisconsin: Whitman Publishing Company, 1947. 383 p. $0.59, with a minimum packaging of 6 copies.

All of the stories are original and are as varied as the animal kingdom itself. There are stories of pets, of farm animals, animals at the zoo, the circus, in far away places, and even about the child's own animal toys. There are factual stories, true stories, humorous stories, and fanciful tales. The literary style is such as to make the story so realistic the child feels he has had a real experience. Illustrations in black and white, and in color by Dorothea J. Snow add much to the attractiveness of the book.

Elementary teachers will find here many interesting stories to read and tell children. Intermediate grade children can read the stories with ease and will enjoy them thoroughly. Children will want to learn to read in order to read these stories for themselves. And they are all brief enough to hold the child's interest to the end.

C. M. P.

Cunningham, Virginia. *Those Cats.* Racine, Wisconsin: Whitman Publishing Company, 1949. Unpaged. $0.59 with a minimum packaging of 6 copies.

Those Cats is a human interest story both adults and children will enjoy. It would make an ideal present for any first or second grade child. The book is illustrated in color and comes in a jacket that would make a most attractive picture for the children's room. The print is large, on clear white paper and the pictures are very decorative and beautiful.

C. M. P.

Meyer, Jerome S. *Picture Book of the Weather.* New York: Lothrop, Lee and Shephard Co., Inc., 1948. 48 p. $2.00.

Individuals remembering the author's delightful earlier books *Picture Book of Astronomy* and *Picture Book of Molecules and Atoms* will welcome this newer title on weather. Children are always weather conscious and interested in why it is always changing. Weather principles and changes are so scientifically told that teachers can profit from reading this book and yet are explained in a literary style children will understand and enjoy. Pertinent illustrations by Richard Floethe add to the children's understanding and appreciation of the textual material. Children from the intermediate grades up can readily use the book.

C. M. P.

Walpole, Ellen Wales. *Tell Me.* New York: Hinds, Hayden and Eldredge, Inc., 1947. 160 p. $2.75.

The author, a well known teacher in Canada and the New York City area, spent more than twelve years studying the questions most frequently asked by children, including two whole years of checking and re-checking the adequacy of the answers. She is author of *The Golden Dictionary* and *Reading and Writing.*

Tell Me answers 290 questions children ask most frequently. Science questions seem to greatly predominate.

There are 29 questions in several categories including animals, plants, myself (over half scientific), places (mostly science), things, machines and sky. At least 190 of the 290 questions are definitely science questions. What a good argument for elementary science in the schools! And how inadequately are the present needs of children in this area being met!

This is an excellent book for parents and teachers.

C. M. P.

Hollos, Clara. *The Story of Your Bread.* New York: International Publishers, 1949. Unpaged. $1.50.

This is the story of bread from the stone-age man down to the present time. Illustrations, primarily in brown and white, are by Laszlo Roth. There are clever drawings of many of the discoveries that preceded modern bread and the many steps that bread has passed through before it reaches you. In general the book is probably best suited for the upper intermediate grades. It is an excellent book to use in the study of foods or bread.

C. M. P.

Tresselt, Alvin. *Johnny Maple-leaf.* New York: Lothrop, Lee and Shepard Co., Inc., 1948. 28 p. $2.00.

This is the story of the cycle of the seasons told from the point of view of a little maple leaf, from the time it breaks out of its tight brown bud in the spring until it finally falls to the ground for its winter sleep. It tells the story of what happened beneath the tree, about the various animals that come to play. The textual material is about second or third grade in difficulty. It is probably meant to be read to the child. The attractive pictures in color by Roger Duvoisin are the most important part of the book.

C. M. P.

Black, Irma Simonton. *Toby: A Curious Cat.* New York: Holiday House, 1948. Unpaged. $1.50.

This is the apartment house story of Toby, a curious yellow kitten who wanted to investigate everything. When Toby came to his new home he was a tiny, yellow kitten full of funny, lovable antics. Children who love kittens and other animals will thoroughly enjoy this delightful story. The black and white illustrations by Zhenya Gay will appeal to children. The textual material is suitable for the primary grades. It is to be recommended as a delightful supplementary science book.

C. M. P.

Rounds, Glen. *Stolen Pony.* New York: Holiday House, 1948. 154 p. $2.00.

Stolen Pony is a story that will be thoroughly enjoyed by every boy and girl who reads. Nor is it likely that they will soon forget it. Few

human friendships are more lasting, few human stories more moving. It is the story of a blind pony and his staunch friend, a dog. The pony is stolen and turned loose by the thieves far from home when they discover the pony is blind. So begins the gripping account of their heroic return. Danger and privations face the pair on every hand. Everything depends upon the dog's good judgment, his faithfulness, and self-denial. The pony trusts him completely, and so does the reader.

So delightful is the literary style, so real the events that one almost feels everything did happen as it is told in the story.

In the story both the horse and the dog are unnamed, but Sniff would be a good name for the dog. A delightful story to read to primary children, and upper grade children will even enjoy it more. It is one of the finest stories for children the reviewer has read in a long time.

C. M. P.

NESBIT, PAUL W. *Instructive Nature Games.* Estes Park, Colorado: Paul W. Nesbit, 1947. 36 p. $0.75.

This is a description of nature games selected and developed for their teaching and entertaining value, mostly afield. Teachers who conduct field trips and leaders who conduct hikes should find many of the games useful. Scout leaders and camp leaders should find the book very worthwhile.

Games described include fetchit, nature nuts, games using nature characters, treasure hunts, password, games of recognition, games of naming, true and false commands, and cycles of nature.

C. M. P.

NESBITT, PAUL W. *New Techniques for Efficient Teaching.* Estes Park, Colorado: Paul W. Nesbit, 1947. 80 p. $1.00.

The author says the three great boredoms of the classroom are reading, writing, and listening. Teachers overwork them because they are expedient and give an outward appearance of order and accomplishment. They are about the only activities that many teachers do not repress. The author proposes to do something about the three boredoms. He lists eleven psychological principles. He proposes as one teaching device the use of a system of question-answer cards. Members of the class compete with each other. In all, the author presents eleven methods. All are variations of the question-answer card procedure. The methods are entitled: password, oral-circular, judging, pair-check, earn-and-check, (long-time set up), earn-and-check (short time set up), self-check, know-for-sure, trail puzzle, idea-fitter, and paired contests.

The author's Master's Degree obtained at the University of Colorado in 1935 used the device called "Trail Puzzle." He used six classes in biology involving 166 pupils. Test results and pupil opinion favored the new method over the usual methods of teaching biology. Some years later the author repeated the experiment for two years with three eighth grade and two ninth grade general science classes in Canon City, Colorado. Statistical information is presented. The author invites others to try out the method and correspond with him before and while doing so. Certainly the method is worthy of being tried out by many different teachers teaching many different subjects.

C. M. P.

DIVISION OF CURRICULUM DEVELOPMENT AND THE DIVISION OF ELEMENTARY SCHOOLS. *Science in Everyday Living.* Brooklyn: Board of Education of the City of New York, 1947–48. 87 p.

This is a progress report of source materials for early grades and educational use of a natural area. Dr. Jerome Metzner then on the staff of the Bronx High School of Science served as coordinator and was responsible for the organization of the bulletin as a whole and the preparation of the material on *The Educational Use of a Natural Area.* A number of persons served on the science committee that prepared the report. The introduction considers the following: science in everyday living and science in elementary education; what is a science experience?; concepts and generalizations; the science corner; the schoolgarden; use of museums, botanic gardens and zoos; park projects; and report of two units; Things that Roll and We Play with Shadows.

The second part discusses suggested experiences, problems, activities and developing concepts: (1) Making work easy, (2) Becoming acquainted with living things through the seasons, (3) Experimenting with earth's materials and natural forces (Experiences with Sound, Experiences with Color, Experiences with Water, Experiences with Air and Flight) and, (4) Becoming acquainted with the world. The last twenty-three pages describe "The Educational Use of a Natural Area."

C. M. P.

ANONYMOUS. *A Suggested Science Program for the Elementary School.* Boston: Ginn and Company, 1948. 164 p. $0.92.

Although no author is listed the program follows the outline of the Gerald S. Craig *Our World of Science* series of readers in elementary science and the Craig textbook, *Science for the Elementary School Teacher. Learnings and Activities* are listed for the several topics taken up in each of the science readers. Then follows a specific reference to the methods textbook *Science for the Elementary School Teacher. Learnings* are more often science concepts stated in declarative sentences. *Activities* consist of a variety of suggestions. Each of the eight elementary science readers is considered in turn. This is specifically a book for the teacher and should prove to be exceedingly useful to teachers using that series as well as most suggestive to other teachers not using that particular elementary science series.

C. M. P.

PARTRIDGE, J. A. *Natural Science Through the Seasons.* New York: The Macmillan Company, 1947. 520 p. $3.00.

Elementary teachers who have used this book tell the reviewer that they like it very much. They say that it has so much useful material for their work in art, opening exercises, and regular lessons although they are not teaching elementary science as such.

The calendar for each month with suggested activities and information for each day, the care of pets, discussion on bulbs and plants, the experiences and activities of birds through the various seasons in different places, the excellent art suggestions, suitable poems, nature stories, making leaf prints, seasonal decoration of the room, suggestions for posters, school ground planning, school and classroom gardens are some of the materials elementary teachers especially appreciate.

The approach is seasonal, activities and material being given for each month of the school year. There are about 100 teaching units in science. There are numerous illustrations.

The author is Principal of the Provincial Normal School, North Bay, Ontario. Thus the approach and literary style is quite different from what most American teachers are accustomed.

C. M. P.

ABELL, FRED H. *The How Book of Grade School Science.* Chicago: Standard Science Supply Co., 1948 unpaged.

Listed here are 144 easy simple and instructive experiences for all grades in elementary science. Primarily more of the experiments are in the physical sciences and is intended to accompany the Stansi Kit of Elementary Science materials. Any elementary science teacher having such a list of materials would be very fortunate. The lack of such materials is one of the more serious handicaps to present day teaching of elementary science. The science experiences could be made to fit into almost any kind of elementary science program.

C. M. P.

SYMPOSIUM. *Free and Inexpensive Learning Materials.* Nashville, Tennessee: Division of Surveys and Field Services, George Peabody College for Teachers, 1949. 175 p. $0.25.

This practically free book is especially recommended to science teachers. All of the material listed was examined, catalogued and evaluated. With few exceptions no item was included that cost more than fifty cents.

The material is classified alphabetically and seems especially fine for elementary science, junior high school, and senior high school science teachers.

C. M. P.

FRANK, J. O., AND BARLOW, GUY J. *Mystery Experiments and Problems.* Oshkosh, Wisconsin: J. O. Frank, 1945. 197 p. $2.25.

Mystery Experiments and Problems is for use in science classes and science clubs. The experiments and problems are designed primarily as teaching aids rather than entertainment. Most or all of them can be used as demonstrations by the teacher or by the pupil. In science clubs many of the experiments can be used as stunts for presenting unusual phenomena. Instructions are specific and are often accompanied by an illustration.

Science teachers using this book can increase their teaching effectiveness and pupil interest in the course by using many of the demonstrations suggested.

C. M. P.

ANONYMOUS. *Sources of Free and Low-Cost Materials.* Washington, D. C.: Aviation Education Division, Civil Aeronautics Administration, 1948. 17 p. Free.

Listed are organizations that distribute charts, pamphlets, brochures, and pictures useful at all grade levels for teachers who are interested in aviation education.

C. M. P.

HORKHEIMER, MARY FOLEY AND DIFFOR, JOHN W. *Educators Guide to Free Films.* Randolph, Wisconsin: Educators Progress Service, 1948. 345 p.

This is the eighth edition of America's best known list of free educational films. This list should be in the hands of all persons who use educational films somewhat extensively. It lists 1632 titles of films (of which 500 titles are new) and 242 titles of slide films (of which 105 are new). Under science are listed 60 titles in biology (34 new), 92 titles in chemistry (16 new), 109 titles in general science (19 new) and 73 titles in physics (26 new). In addition there are many films listed under other headings that are as useful to science teachers as those so listed specifically.

C. M. P.

FOWLKES, JOHN GUY AND MORGAN, DONALD A. *Elementary Teachers Guide to Free Curriculum Materials.* Randolph, Wisconsin: Educators Progress Service, 1948. 208 p. $4.50.

This is the fifth edition of the popular and widely used *Elementary Teachers Guide to Free Curriculum Materials.* Junior and Senior High School science teachers will find many of the materials listed quite suitable for their classrooms. Of the thirteen hundred thirty-eight titles, six hundred twenty are new to this edition. Of eighty-two titles listed under science, twenty nine are new. Every school system should make this guide available to its teachers.

C. M. P.

WALTERS, VERNA. *Science Education for the Elementary Schools of Ohio.* Columbus, Ohio: The State Deparmtent of Education, 1945. 192 p.

This is one of the relatively few good state publications relating to elementary science. One of the consultants was Miss Rose Lammel, one of America's better known leaders in elementary

science education. The science committee included Ann Burgess, Mary Melrose, Ollis Fink, Arthur R. Harper, Harold Shane, Richard Outland, W. Hughes Barnes, and Ralph A. Schaller.

Most of the book (about 150 pages) is used in presenting teaching materials on various phases of elementary science for different grade levels. In this teaching material is listed: basic understandings, activities and experiments and basic understandings to be discovered. Other portions of the book discuss the values of science experiences in the elementary school grades, how can science experiences be included in the usual elementary school program, space and equipment needs, and useful books for children and teachers.

C. M. P.

WETHERINGTON, JULIA. *Science for the Elementary School.* Raleigh, North Carolina: State Superintendent of Public Instruction, 1941. 115 p.

Assisting in the publication of this bulletin were committees of teachers and principals in the North Carolina Public Schools. Professor Gerald S. Craig of Teachers College, Columbia University, America's best known leader in elementary science education, served as consultant. Altogether it is deserving of a place among the few very good state outlines in elementary science.

Included are discussions on the place of science in the elementary school, some practices in the present day science program, approaches to curricular content, considerations in providing a program, some specific units in grades one through seven, inexpensive science source materials, professional references, visual aids, experiments and so on.

C. M. P.

SYMPOSIUM. *Using Audio Visual Aids with Children.* Washington 5, D. C.: (1200 Fifteenth Street N. W.) Association for Childhood Education, 1947. 36 p. $0.50.

This is a service Bulletin of the Association for Childhood Education. Contents include: *What Do We Mean by Audio Visual Materials* by Paul G. Reed; *Values and Hazards in Using Audio Visual Materials* by Stephen M. Corey; *Children's Experiences with Audio Visual Materials* (*Through Seeing Experiences* by Charlotte W. Junge, *Through Recordings* by Gloria Chandler, *Through Radio* by Ruth Weir Miller, and *Through Films* by Elaine Debus), and *An Audio Visual Program in Action* by Mark J. Flanders and Evelyn Peterson.

C. M. P.

SYMPOSIUM. *Using Community Resources.* Minneapolis: University of Minnesota Press, 1948. 102 p.

This is a pamphlet prepared by a Committee of the Bureau of Educational Research, Field Studies, and Surveys of the University of Minnesota. It consists of a series of illustrative experience units for grades one to six. The first two chapters are: Enriching learning by using the community and its resources and the nature of experience units. Units are: getting ready for winter, how our community provides for recreation, how do the people in our school help the children in our community, who have been the leaders in the growth of our nation, how has invention of machines and the discovery of electricity changed my school, children's hobbies, who built America, a study of Negro life in the United States, and group living in world communities. Each unit has an overview, objectives, approach, outline of subject matter, activities, evaluation of outcomes, materials used, and references.

C. M. P.

SYMPOSIUM. *Curriculum at Work.* Washington 5, D. C. (1200 Fifteenth Street, N. W.) Association for Childhood Education, 1948. 46 p. $0.75.

This is a service Bulletin of the Association for Childhood Education. After an excellent introduction "Curriculum for Today's Learners" by Florence Stratemeyer, there are numerous short descriptions of the curriculum at work in many different school centers in various areas of learning. These descriptions are anecdotal accounts in three areas of human growth: in individual capacities, in social participation, and in ability to deal with environmental factors and forces. One is by Ruth Lippenberger on "We Study Rocks."

C. M. P.

CALIFORNIA STATE DEPARTMENT OF EDUCATION. *Science in the Elementary School.* Sacramento, California: California State Department of Education, 1945. 418 pp. $1.00.

Science in the Elementary School is a book on methods of teaching science in the elementary school prepared by a committee on science education for the Division of Elementary Education of the State of California. Teachers of science in the elementary schools everywhere will find many valuable suggestions for improving their own methods of presenting science and making it more interesting and vital to pupils in the elementary school. Philosophy, purposes, methods, devices, techniques, content, pupil and teacher references are all considered. Much content material is included.

Chapter headings are: Point of View in Science Education, Effective Learning and Teaching in Science, Using Science Materials in the Classroom, Desirable Outcomes of Science Teaching in the Elementary School, Suggested Methods of Teaching Science Content at Different Maturity Levels, Curriculum Unit on Water and the Fishing Industry, A Curriculum Unit on "Our Creek," and Pupil and Teacher References.

C. M. P.

HILL, RUBY (Editor). *The Elementary School in the Community.* Oakland, California (7921 Ney Avenue): Sarah Young, 1947. 158 p. $2.00.

This is the Nineteenth Yearbook of the California Elementary School Principals' Association. A number of persons contributed articles to the yearbook. Part I: *The Characteristics of a Good*

Elementary School by Bernard J. Lonsdale; Part II: *The School Uses of Community Resources—The Community Survey* by Clarence Fieldstra, *The Long Beach Social Studies Curriculum Uses Community Resources* by La Vonne Hanna, *The Arts and the Community* by Natalie B. Cole, *Language Arts Program Recognizes Community Resources* by Bernice Baxter, *Adapting the Health Program to the Social Needs* by H. B. Masters and Cecyl Havelin, and *Techniques for Utilizing Community Resources* by Paul R. Hanna; Part III: *Interaction of School and Community: Parent Education* by Ralph Eckert, *Out-of-School Experiences* by William Jack Stone, *School Project Becomes a Community Project* by Myrtle Gallinger, and *The Elementary School Board Sponsors the Recreation Program* by Henry Bishop; and Part IV: *Interpreting the Elementary School Program* by John Michaelis.

C. M. P.

PALMER, E. LAWRENCE. *Fieldbook of Natural History.* New York: McGraw-Hill Book Company, 1949. 664 p. $5.00.

Fieldbook of Natural History is an unusually comprehensive guide to natural history. The book embraces birds, fish, plants, rocks and minerals, the stars, mollusks, reptiles and animals—more than 2,000 items and hundreds of illustrations. Each item has its descriptive identification, followed by data on range and location, life history, ecology and economic importance. Each item is illustrated with a detailed drawing or photograph for guide and correct identification. Common names are given in every case and for the advanced student of natural science, technical classification of division, order, and family are provided.

This is an unusually fine guide for elementary science, general science, and biology teachers. Teachers on the college level will find it useful in certain phases of their courses.

C. M. P.

WRIGHT, ALBERT HAZEN, AND WRIGHT, ANNA ALLEN. *Handbook of Frogs and Toads of the United States and Canada.* Ithaca, New York: Comstock Publishing Company, 1949. 640 p. $6.50.

This is the third edition of a book first published in 1933. It has been very widely used. Descriptions include common and scientific names, range (often map included also), habitat, size, color, picture, general appearance, structure, voice, breeding, and considerable other interesting information. It is a good reference for the elementary science, general science, and biology teacher.

C. M. P.

SWAIN, RALPH B. *The Insect Guide.* Garden City, New York: Doubleday and Company, Inc., 1948. 261 p. $3.00.

This guide covers more than 250 insect species. The more than 450 illustrations (330 in full color) were made by the author's wife, Suzan N. Swain.

The guide tells: how to recognize the larger, more easily remembered groups of insects in the United States and Canada; how to distinguish adult and immature insects by their appearance and habits; how to find, capture, observe, and preserve different kinds of insects; and how better to appreciate insects by understanding their relationships with plants, man, and other animals.

This should serve as a practical guide for biology, general science, and elementary science teachers.

C. M. P.

CURTIS, MARY I. *Our State Birds.* Chicago: Lyons and Carnahan, 1947. 122 p. $1.20.

Each state and the United States has selected a bird to represent it. The birds have been selected in various ways: school children, State Audubon Society, State Federation of Women's Clubs, and state legislatures. Each state bird is pictured in color. There are 26 different state birds. Much interesting information is presented about each of the state birds. It is an excellent book for the upper intermediate grades or the junior high school. Elementary teachers will find the book quite useful.

The birds and the states they represent: Bald Eagle—United States; Cardinal—Indiana, Illinois, Kentucky, Ohio, and North Carolina; Mockingbird—Florida, Arkansas, Mississippi, South Carolina, Tennessee, and Texas; Western Meadowlark—Montana, Kansas, Nebraska, North Dakota, Wyoming, and Oregon; Robin—Michigan, Virginia, Wisconsin, and Connecticut; Wood Thrush—District of Columbia; Hermit Thrush—Vermont; Eastern Bluebird—New York and Missouri; Flicker—Alabama; Black-capped Chickadee—Massachusetts and Maine; Lark Bunting—Colorado; Mountain Bluebird—Idaho and Nevada; Tufted Titmouse—West Virginia; Purple Finch—New Hampshire; Brown Thrasher—Georgia; Goldfinch—Iowa, Minnesota, and New Jersey; Willow Goldfinch—Washington; Baltimore Oriole—Maryland; California Gull—Utah; Arizona Cactus Wren—Arizona; Road Runner—New Mexico; Ring-necked Pheasant—South Dakota; California Quail—California; Ruffed Grouse—Pennsylvania; Brown Pelican—Louisiana; Blue Hen Chicken—Delaware; Bobwhite—Rhode Island and Oklahoma.

C. M. P.

EVANS, EVA KNOX. *All About Us.* New York (139 Fifth Avenue): Capitol Publishing Company, Inc., 1947. 95 p. $2.00.

All About Us is the story of people: their beginnings, their wanderings over the earth, and the changes in skin color, customs, and language that resulted from separation and different environment. The author applies scientific truths to the everyday life of children. For as she writes "People are so special because they are us." It tells why we are different and why we are alike. It is a book for children to read themselves, probably best suited for the junior high school level. It is a story to read aloud and talk about in homes, schools, and churches. It is a good

book for adults, too. It is one of the finest books on race that has been published and should be read by boys and girls (as well as their parents and teachers!) everywhere.

C. M. P.

SYMPOSIUM. *Individual Laboratory Lessons in Biology.* Brooklyn (911 Flatbush Avenue): George Davison, 1948. 63 p. $0.75.

This is a manual of individual laboratory lessons in biology prepared by a Committee of the New York Association of Chairmen of Biological Sciences and the New York Association of Teachers of Biological Science. It consists of two parts: Part I—Hints to Teachers (this includes aim of lesson, materials needed, and helpful comments), and Part II—Suggested Directions for Students.

There are 48 experiments. The committee tried to restrict itself to exercises that can be completed within the average school period. Biology teachers outside of New York City may find the list suggestive and quite useful.

C. M. P.

SYMPOSIUM. *Safety in General Science.* Brooklyn (110 Livingston Street): Board of Education of the City of New York, 1948. 44 p. $0.20.

This is a resource unit for use in ninth grade general science. The following aspects of safety are considered: fire, foods and drugs, eyes, weather, plants and animals, and electricity. For each unit are listed: outcome ideas, topics for discussion and suggested activities. Here is some excellent material and ideas for all general science teachers to incorporate into their general science teaching. C. M. P.

FRANK, JOSETTE. *Comics, Radio, Movies and Children.* New York (22 East 38 Street): Public Affairs Committee, Inc., 1949. 32 p. $0.20.

This booklet presents the major problems of comics, radio, and movies in a sound and balanced way, and does not take an extreme position on either side. It is especially useful and reassuring to parents, teachers, and other citizens interested in the welfare of children.

There are some excellent suggestions as to what parents can do, what teachers can do, and what the community can do. C. M. P.

BOTE, GEORGE S., AND LAIRD, DOROTHY STEVENS. *Roddy the Rat.* Gainesville, Florida: Project in Applied Economics, College of Education, University of Florida, 1949. 72 p. $0.15.

Roddy the Rat is a story of the spread of typhus fever and ways of getting rid of rats. The booklet is designed to improve community living and deals with a problem that is found nearly everywhere—the control of rats. Rats are agents in spreading a number of different diseases. It is an excellent unit for boys and girls in general science and biology classes and for the elementary science teacher. C. M. P.

CURTIS, MARY I. *Conservation in America.* Chicago: Lyons and Carnahan, 1947. 118 p. $1.16.

In the material realm Americans face no greater problem than the problem of conservation. And as a people relatively little has been done and relatively few show genuine concern. Actually only a small start has been made, but the shortages are beginning to be evident. It would have been so much easier and simpler to have started earlier. It is not too late now, but the effort and the total cost have been greatly increased.

Only one phase is considered in this book—forests. Of course forest conservation is closely tied up with soil, water, and wild life conservation. This is an excellent book for the junior high school pupil to read. Numerous illustrations accompany the textual material.

C. M. P.

STEPHENS, DOROTHY C. *Pineville High Meets the Challenge.* Gainesville, Florida: Project in Applied Economics, College of Education, University of Florida, 1948. 54 p. $0.15.

This is one of a series of pamphlets published through a grant from the Alfred P. Sloan Foundation. It is the story of the effects of hookworm and the ways of treating and preventing the disease. It shows how the boys and girls of Pineville High School met and solved a serious health problem. This book is a valuable contribution for students and teachers living in areas where hookworm may be found.

C. M. P.

PADGETT, ELSIE. *Indoor Climate.* Gainesville, Florida: Project in Applied Economics, College of Education, University of Florida, 1947. 40 p. $0.35.

Indoor Climate is one of a series of science readers for the junior high school designed to help schools serve their communities by teaching about the three basic needs of food, clothing, and housing. It is the account of the effort of one small family to find a house, moderately priced, which will fill their need for comfortable summer and winter living. Many basic facts and understandings in air conditioning and house construction are presented. The book presents much useful information for junior high school pupils and general science teachers.

C. M. P.

PADGET, ELSIE. *The Case of the Whispering Class.* Gainesville, Florida: Project in Applied Economics, College of Education, University of Florida, 1947. 56 p. $0.35.

This is really a science reader for the junior high school dealing with the problem of personal cleanliness. It is intended that the pupil recognize the problem as individual and apart from all responsibility but his own and that he may be willing to analyze and evaluate his own habits of cleanliness. Much of the booklet is in story form with questions. There are black and white illustrations by Harrison Covington.

C. M. P.

Brown, H. Emmett, and Schwachtgen, Edward C. *Physics: The Story of Energy.* Boston: D. C. Heath and Company, 1949. 593 p. $3.20.

Physics: The Story of Energy is a *different* high school physics text. The authors have dared to break away from the traditional sequence of subject-matter and equally or probably more important the actual presentation of the subject-matter. The emphasis is upon the inductive method and the use of experimental data. The scientific method is stressed whenever possible. Experimental data are used extensively. Students are able to see how data are derived and how generalizations may be made from such data. Tables represent the kind of data a student would find if he did the experiments. Mathematical difficulties are lessened through step-by-step development of equations accompanied by demonstration problems.

The first unit is on sound energy and consideration is first given to sound measurement. Many high school teachers will be skeptical regarding such an introduction. However, this approach has been tried out successfully in a number of high schools. A number of things can be said in its favor. It would seem to be advantageous psychologically and pedagogically. Boys and girls are very much interested in sound and music—especially because of the present day high school emphasis upon music. This natural interest makes for a good first approach to physics. The reviewer has always found pupils to be intensely interested in sound and the physical sound aspects of music. And in difficulty the understanding of sound will not be any more difficult for girls especially than the old fluids or machines approach.

The unit on sound is followed by a unit of light energy, a unit on energy and the work of the world, a unit on electrical energy, a unit on energy and motion, and a unit on energy and molecules. The last chapter of the final unit is on the sun in relation to weather and climate.

Each unit is divided into a varying number of chapters, each chapter being further subdivided into problems. Each unit begins with a challenging overview, with a summary, things to do, questions, problems, exercises for advanced study, and references at the close. Many well-selected and appropriate illustrations are utilized as an important phase of the learning process.

Many teachers will welcome this new approach and new emphasis. The authors deserve high commendation for a book that may prove exceedingly popular because of the changed sequence, the inductive approach, the new subject-matter, and the practical pupil and teacher helps.

C. M. P.

Grant, Charlotte L., Cady, H. Keith, and Neal, Nathan A. *American High School Biology.* New York: Harper & Brothers, 1948. 888 p.

American High School Biology is typically an American high school textbook in biology. This means a high standard of excellence in every way—content, literary style, major points of emphasis, teaching devices, and learning techniques. It emphasizes conservation, personal and public health, safety, heredity, eugenics, structure and function of living things, projects, a variety of teaching aids, specific references to appropriate biology films, and excellent photographs and illustrations. The photographs include scenes from the teaching films of Encyclopedia Britannica Films and thirty unusually fine full page photographs by Miss Berenice Abbott, one of America's best known photographers. Teaching aids include the use of italics to help pupils and teacher. Among other numerous teaching aids are *Do You Know These Terms?, How Would You Answer These?, Things You Have Learned in this Unit, Projects for You, Ideas to Understand in this Unit,* and *Related Reading for You.*

The authors have attempted to relate the basic principles of biology to the student's own experience in every way possible. The units are so organized that the text is as suitable for beginning the course in mid-year as in the fall. For example Unit One may be used in the fall or spring. There are forty chapters with the ten following units: The Out-of-Doors in Autumn and Spring, Food for Living Things, Food for Body Building, Body Processes at Work, Living Things in Action, Keeping the Body Healthy, The Story of New Life, Continuing Life on Earth, Plants and Animals in Balance, and Living with Living Things.

The authors are well known high school teachers of many years' experience. Dr. Grant is Head of the Department of Biological Science in the Oak Park Township High School, Oak Park, Illinois. Mr. Cady teaches biology in the same school. Mr. Neal taught science for many years in the Cleveland, Ohio, schools. Later he was Director of Radio Broadcasting for the Cleveland schools, and presently is Editor in the Secondary School Department of Harper and Brothers.

C. M. P.

Kroeber, Elsbeth, and Wolff, Walter H. *Adventures with Plants and Animals.* Boston: D. C. Heath and Company, 1948. 600 p. $3.20.

Adventures with Plants and Animals has an apt title that does not belie its contents. Pupils studying the text will see the course in biology as an adventure, and for the most part a very happy adventure. It has many features that will appeal to both pupils and teachers. The non-glare paper, the numerous and interesting illustrations, the easy-to-read double columns, the readable style, the suggested demonstrations and laboratory exercises, the "Further Activities" all contribute to making this a book both teachers and pupils will like. A pupil workbook and laboratory manual and a teacher's manual are in preparation.

There are ten units with a variable number of sub-topics: (1) The living things of the earth are many and variable, (2) All living things are

basically alike, (3) Green plants make the food used by all living things, (4) How a complex animal uses food for energy and growth, (5) Why living things behave as they do, (6) Constant care is needed for maintaining our health, (7) How living things affect one another, (8) How animals and plants make more of their own kind, (9) The organism is the product of its heredity and environment, and (10) The earth and its inhabitants have changed through the ages.

C. M. P.

FULLER, ROBERT W., BROWNLEE, RAYMOND B., AND BAKER, D. LEE. *Elements of Physics.* Boston: Allyn and Bacon, 1948. 837 p. $2.20.

Elements in Physics is probably the most popular and widely used textbook in high school physics. This postwar edition brings the content and approach up to date. The last war was particularly a scientists' war with a major emphasis upon physics. The war impact and the peacetime considerations receive appropriate emphasis in this new edition. This is illustrated by a chapter on vacuum tubes and atomic physics, a chapter on radio communication, and a unit on land and air travel.

Units are as follows: (1) Matter and molecules, (2) Behavior of fluids, (3) Mechanics of solids, (4) Heat, (5) Sound, (6) Light, (7) Magnetism and electricity, and (8) Land and air travel. Demonstrations introduce each topic. Many questions and exercises, summaries and word-lists provide real pupil helps. The illustrations should be especially effective.

Altogether the book provides a thoroughly sound, effective, interesting approach to a most important area of secondary science teaching.

C. M. P.

HUNTER, GEORGE W., AND HUNTER, F. R. *Biology in Our Lives.* New York: American Book Company, 1949. 534 pages. $3.40.

The late senior author was one of America's best known and earliest textbook writers in the fields of general science and biology. His earlier books in these fields went through several revisions and were well received because of their simplicity in style and practicality in viewpoint. His last activity was the writing of material for this new biology. For many years he was a teacher of science in the New York City schools and later taught science education methods in the Claremont Colleges. His son F. R., the junior author, carried the writing on to completion after assisting in the first phase of the work. He is now professor of physiology at the University of Oklahoma.

George W. Hunter would have every right to feel proud of a job well done had he lived to see the completion of his last work. Social, economic, and civic aspects of biology receive a major emphasis. Yet there does not seem to be an overemphasis along this line for fundamental facts and principles in biology are certainly not neglected.

The main body of the text consists of five sections composed of ten units, each of which is presented in the form of a number of problems covering the unit topic. An introductory section on "Biology and How We Study It" defines and explores the field of study. It discusses the scientific attitudes and presents a step-by-step development of the scientific method, the problem solving techniques that should be considered equal in value to the mastery of the subject matter itself. Extensive use is made of a great variety of teaching and learning aids. Each unit begins with a motivational preview of the contents and their implications for the reader. Italics are used to emphasize new and important words which are accompanied by diacritical markings and definitions when necessary. Problem questions, along with activities, reports, and projects adapted for varying levels of ability provide ample material for individual and group assignments. There are self-tests of the fill-in and true-false type, tests of reflective thinking, and exercises on scientific attitudes and methods. There are rather extensive unit bibliographies.

Undoubtedly *Biology in Our Lives* will have wide usage and be well liked by the many pupils and teachers using it.

C. M. P.

FOWLER, GEORGE W., AND THURSTON, ERNEST L. *A Laboratory Guide in General Science.* Syracuse: Iroquois Publishing Company, 1947. 151 p.

This guide includes experiments, applications, projects, exercises, tests, suggestions to the teacher, and needed laboratory equipment. Experiments in sixteen science units are included.

C. M. P.

SANDERS, EDWIN F., AND GOLDSTEIN, PHILIP. *Practical Biology Workbook.* New York: D. Van Nostrand Company, Inc., 1949. 130 p.

This is a detachable loose-leaf high school biology workbook designed to accompany the textbook *Practical Biology* by Sanders. It combines notebook, homework book, laboratory manual, and suggestions book. *Doing* type of activities are emphasized.

C. M. P.

HARER, EDWIN L., AND REMLEY, CHELSEY G. *Fundamental Activities in Biology.* New York: Republic Book Company, 1947. 302 p. $1.20.

This is a high school biology workbook and laboratory manual designed for use with any textbook. Activities are listed for nine units of subject matter. Included are pupil and teacher references as well as detailed cross-references to various biology textbooks.

C. M. P.

IDELSON, MICHAEL N. *Mastery Units in Physics.* New York: Republic Book Company, 1947. 290 p. $0.60.

First published in 1936 by the Colonial Book Company, this is the fifteenth revision. So many revisions indicates popular usage. This is prob-

ably accounted for by its emphasis upon fundamental applications, the many understandable illustrations called "functional ideographs," pupil problems, questions, pupil self-tests, the handy pocket-size, and the low costs. It serves a real need for all those pupils who want an understandable supplementary reference to go along with the regular classroom textbook and especially those New York students preparing for the New York State Regents Examination. There are good review exercises and examples of several typical high school examinations in Physics. Several recent New York State Board of Regents Examinations in Physics are included.

C. M. P.

STEWART, FRANK E. *Basic Units in Physics.* New York: Republic Book Company, 1947. 380 p. $0.75.

Basic Units in Physics was edited by Michael N. Idelson and Raymond Agren. The content meets the requirements for high school physics as set by state prescribed courses and the College Entrance Examination Board. The book would serve admirably as a supplementary text or as a basic text. Diagrams are in color and there are numerous short-answer, self-testing questions, review questions, and problems. There does not seem to be much duplication of Idelson's *Mastery Units in Physics* reviewed above. Rather the two books would seem to supplement each other.

C. M. P.

JOHNSTON, JOSEPH E. *Basic Units in Chemistry.* New York: Republic Book Company, 1947. 412 p. $0.75.

The content of *Basic Units in Chemistry* meets the requirements for high school chemistry as prescribed by state syllabi and the College Entrance Examination Board. The book probably has its greatest usage as a supplementary text to the basic text being used, although it could itself serve most adequately as the basic text. There are numerous, clear, and instructive diagrams in multi-color. Abundant self-testing exercises, review questions, and problems are found at the end of each chapter.

C. M. P.

CARLETON, ROBERT H., AND CARPENTER, FLOYD F. *Chemistry for the New Age.* Chicago: J. B. Lippincott Company, 1949. 688 p. $3.20.

Chemistry for the New Age is intended to serve a two-fold purpose as a high school text: (1) to contribute generously and effectively to the general education of all students and (2) to lay the foundations needed by some of the students for later specialization in science. In the opinion of the reviewer these two purposes will be adequately accomplished for those pupils using this book as a basal text.

Many fine things can be said about this book. Facts, concepts, and principles are presented and emphasized in such a way as to give opportunities for growth in the skills and abilities involved in problem solving. The approach is direct, practical, and correlated at every opportunity with the other sciences and with the everyday activities of youth who live in the science world of today. Many pupil and teaching aids are provided: well-selected, appropriate illustrations; overview of the unit, pupil tests of knowledge and understanding, "highlights," application exercises, problems, exercises in scientific problem solving, interesting things to read, and a helpful 14 page glossary. Here is one text that not only gives lipservice to scientific problem-solving but provides specific exercises to provide training for its growth and development.

There are ten units, broken down into twenty-two chapters, and fifty-eight sub-problems. The latter are stated as questions which are then answered specifically.

Altogether *Chemistry for the New Age* is an unusually fine high school chemistry text. It should prove very popular both with teachers and pupils. Mr. Carleton is Executive Secretary of the National Science Teachers Association. Beginning as a science teacher in Dayton, Ohio, for many years he taught chemistry and served as chairman of science education in the Summit, New Jersey, public schools. Later he served as assistant professor in the Newark, New Jersey, College of Engineering and as assistant professor of physical science at Michigan State College at East Lansing. He is co-author with Harry H. Williams of *Modern Life Science* and *Physics for the New Age.* Mr. Carpenter is Principal of the Stivers High School, Dayton, Ohio.

C. M. P.

SMITH, FREDRIKA SHUMWAY. *John Greenleaf Whittier: Friend and Defender of Freedom.* Boston: Christopher Publishing House, 1948. 228 p. $2.75.

John Greenleaf Whittier, often called "The Quaker Poet," had a sense of love and loyalty to freedom and country that many Americans of today need to be reminded. An obstinate foe of slavery, during his life he was known far and wide for his fight for freedom for all men. Few men were more devoted to his dearly beloved United States. No one could ever question where his loyalty lay. This is delightful biography for any boy or girl and especially if they have an acquaintance with any of his well known poems.

C. M. P.

LINDQUIST, ORVILLE A. *Common Fallacies Regarding United States History.* Richmond, Virginia: The Dietz Press, Inc., 1948. 99 p. $1.00.

The American public is guilty of harboring many false beliefs. The author has collected several thousand. He has found that, except for animals, there are more untruths regarding United States history than any other subject. This book lists many of these fallacies and indicates the reason for so stating. Under each fallacy two sources of information are given for any readers who wish to do further reading regarding the subject matter of the paragraph.

This will prove an enlightening book to most Americans who are not historians. It should be interesting and enjoyable reading for every true American.

C. M. P.

BAILEY, OLIVE. *Christmas with the Washingtons.* Richmond, Virginia: The Dietz Press, Inc., 1948. 44 p.

The subtitle states "this is a special account of traditional rites observed in Virginia and historic yuletides of one first family, the Washingtons of Mount Vernon." There are drawings by Worth Bailey. Beginning with the Christmas of 1751 the author describes most of the Christmas celebrations of George (and later Martha) until the last one in 1798. They were usually joyous, festive occasions with church attendance as a regular part of the celebration. Even during the Revolutionary War period, Martha usually spent the Christmas season, if not always Christmas Day, with George. During the rest of the year Martha was back on the Virginia farm.

This is a nice book for a gift and to read!

C. M. P.

THE VIRGINIA FEDERATION OF HOME DEMONSTRATION CLUBS. *Recipes from Old Virginia.* Richmond, Virginia: The Dietz Press, Inc., 1948. 287 p. $2.00.

Many of the recipes come from the kitchens of yesteryear, but all of them have been recently tested by many members of the Virginia Federation of Home Demonstration Clubs.

Memories and the descriptions of these old and tried recipes are evidence that the cooks of yesteryear have few counterparts today. Modern utensils and devices, refrigeration, cold storage, and commercial preparation has greatly lessened the need for "cooking artists." This is a book for the man as well as the woman. It is said on good authority that some science teachers are better cooks than their wives! Be that as it may here is a book with over seven hundred recipes of two centuries collected from the kitchens of the Old Dominion that will prove a delight to anyone interested in better ways of preparing enticing foods and drinks.

C. M. P.

CARSKADON, THOMAS R., AND MODLEY, RUDOLF. *U. S. A.: Measure of a Nation.* New York: The Macmillan Company, 1949. 101 p.

This is a graphic presentation of America's needs and resources. It was prepared by The Twentieth Century Fund and is based on that outstanding volume *America's Needs and Resources* published by The Twentieth Century Fund in 1947. This briefer volume lacks the prodigious detail of the book on which it is based. It is designed to give the reader a high-spot knowledge of our resources—natural riches, manpower, and machines. It gives us an overall picture of American economy. The most outstanding feature of this brief volume are the numerous charts, usually picture-charts, that are at once both challenging and so effective in putting across an idea. They summarize a vast amount of information in a few striking symbols. Every American teacher, in fact every American from the junior high school age on should own, possess or have access to this unusually fine publication. America's future depends upon our attitudes toward the problem and what we do about it.

C. M. P.

SPIVACK, MORRIS J. *Vital Correlations.* Bayonne, New Jersey (102 W. 39th St.): Morris J. Spivack, 1949. 24 p. $0.75.

Vital Correlations is subtitled *A Unification of Knowledge in Three Dimensions including a Mathematics of Ideas.* The author attempts to construct a lattice which he maintains will enable one to solve any and every intellectual question that may arise. Details of the author's theory are too complex to be adequately described in a short review.

C. M. P.

KANDER, MRS. SIMON (Compilator). *The Settlement Cook Book.* Milwaukee: The Settlement Cook Book Company, 1947. 623 p. $2.50.

Here are over 3,000 tested recipes from the Milwaukee Public School Kitchens, Girls Trades and Technical High School, authoritative dietitians, and experienced housewives. This is the twenty-eighth edition of this popular recipe book. The directions are simple and avoid waste of materials and effort. The book is carefully indexed and includes sample menus, directions for canning, and quick-freezing.

C. M. P.

HINES, DUNCAN. *Adventures in Good Cooking and the Art of Carving in the Home.* New York: Duncan Hines, Inc., 1947. Unpaged.

This is the seventeenth edition of *Good Cooking* by the author of *Adventures in Goot Eating* and *Lodging for a Night.* Each recipe is numbered and credited to the particular contributor. Many recipes are from famous hotels, eating places, and wellknown men and women. Each recipe is indexed under an appropriate heading. There are 525 numbered recipes. Illustrated directions for carving various kinds of meats conclude the last forty or so pages of the book.

C. M. P.

SMITH, ELVA S., AND HAZELTINE, ALICE I. *Just for Fun.* New York: Lothrop, Lee and Shephard Company, Inc., 1948. 332 p. $2.75.

This is a collection of humorous stories and poems suitable for the leisure hour. It is a book one enjoys picking up and reading a story or poem here and there and then laying it aside to return to it at a later time. It is a book to make you laugh and high school youngsters will especially enjoy it. But even grownups will re-live the stories and poems they once have read. They range all the way from Emily Kimbrough's account of the first appearance of the automobile in Indiana, Frank Stockton's *Casting*

Away of Mrs. Lecks and Mrs. Aleshine, Howard Spring's *Tumbledown Dick*, Charles Warner's *How I Killed a Bear*, the *Curse of Gold* by Robert H. Davis and such other well-known writers as Mark Twain, Booth Tarkington, Charles Dickens, Washington Irving and others.

C. M. P.

HASLOM, R. T. *World Energy and World Peace.* New York 20 (Room 1626, 30 Rockefeller Plaza): Standard Oil Company, 1948. 16 p. Free.

This is an address by the Vice-President of the Standard Oil Company of New Jersey. Congressman Herter of Massachusetts is quoted as saying that 85 per cent of all government expenditures from the founding of our republic down to the present have been in preparation for war, for war, or for the aftermath of war.

Four "climates" in which peace is likely to prosper are: (1) a world in which the people rule, (2) a world in which maximum freedom and opportunity are given to the individual, (3) a world in which production is expanding, and (4) a world in which we keep the virtues of national feeling but begin to outgrow some of the vices of nationalism.

In 1947 the United States ceased being a net exporter of oil and became a net importer of oil. The United States with 7 per cent of the world's population uses 45 per cent of the world's fuel. The people of the world, outside the United States, consume 20 per cent more total energy, but actually only use 10 per cent as much per person as the United States. In the United States oil and gas supply 45 per cent of our total energy used for all purposes with coal supplying about an equal amount. Coal production has remained about constant for the last 20 years.

C. M. P.

BLANCHE, ERNEST E. *You Can't Win.* Washington, D. C.: Public Affairs Press, 1949. 155 p. $2.00.

You can't win at gambling for these 13 reasons, according to Dr. Ernest Blanche, a logistics expert of the Army General Staff who has spent a life time in the analysis of wagering games.

1. Every system of betting breaks down and fails sooner or later.
2. So-called skill games are really games of chance that even the most skilled players can't beat.
3. The mathematical probabilities are always against the bettor.
4. Gambling has always been and always will be a crooked business.
5. The odds are inevitably against the dice tosser.
6. The roulette operator is ahead of the game before it even starts.
7. Carnival wheels are invariably "fixed."
8. Only the race track operators are sure of their "take."
9. The numbers racketeers get from 46 per cent to 55 per cent of the money wagered by the public.
10. The card "sharper" uses a score of tricks to deceive the amateur.
11. Most of the tickets for the Irish Sweepstakes sold in the United States are counterfeit.
12. Punch boards pay out less than half of what they take in.
13. You have only 1 chance in 2,000 of getting any money back in a chain-letter scheme or in Pyramid Club participation.

In this book Dr. Blanche brings together all of his findings regarding trickery and mathematic odds in dice and card games, betting on horses, the numbers, lotteries and polls, pin-ball and slot-machines, roulette, carnival games, bingo, the chain letter and pyramid schemes, and various other gambling games. He points out that 50 million Americans participate in such games without realizing the odds against them.

In his professional capacity, Dr. Blanche is considered one of the nation's mathematical wizards. He is Chief Statistician for the Logistics Division of the Army General Staff and a frequent contributor to learned journals. In his private capacity, he's America's chief debunker of gambling. His work-den in his Chevy Chase, Maryland, home is a veritable museum of gambling history.

C. M. P.

JOHNSON, KATHRYN M. *The Dark Race in the Dawn.* New York: The William-Frederick Press, 1948. 16 p. $0.50.

This pamphlet is based on a three-volume work by Leo Wiener entitled *Africa and the Discovery of America.* Its purpose is to offer evidence of a black African civilization in the Americas before Columbus. Evidence is primarily based on tools, weapons and artifacts discovered in various mounds.

C. M. P.

HERCHMER, JEAN. *Science and the Resurrection.* New York: The William-Frederick Press, 1947. 27 p. $0.50.

The author maintains that prolonged life and the resurrection of the dead are scientifically sound. Man of the future will have greatly prolonged lives according to the author. Science is making definite progress along that line. Proofs of resurrection as given by the author are based primarily on faith and philosophical beliefs.

C. M. P.

STAUNTON, WILLIAM F. *Old Age and a Future Life.* New York: The William-Frederick Press, 1947. 23 p. $0.50.

Is there life after death? Here is one answer to the question that thinking people are always asking. Some are eternally alarmed; some affirm simply that they do not know; some are positively convinced there is not; others are persistently reassured that there is. Yet none fail to realize that the question is as real as it is the essence of what we make of our life on earth.

The author nearing his eighty-sixth birthday affirms his belief that there is but says as did Cicero "I know not how."

C. M. P.

CRARY, RYLAND W., EVANS, HUBERT M., GOTTLIEB, ALBERT, AND LIGHT, ISRAEL. *The Challenge of Atomic Energy.* New York: Bureau of Publications, Teachers College, Columbia University, 1948. 92 p. $0.90.

This is a resource unit and discussion guide for teachers and group leaders. Contents include: (1) The atomic challenge, (2) Atom smashing comes of age, (3) Social implications of atomic energy, (4) Critical thinking for a new world, (5) Suggestions for teachers and discussion leaders, (6) Audio-visual materials, and (7) Selected references. There is a list of questions at the beginning of each chapter and a list of pertinent references at the end.

Science teachers on both elementary and secondary level will find this a practical, well-planned, resource unit. General Science, Chemistry, and Physics teachers are neglecting a very important duty when they fail to give some time to considerations of atomic energy.

C. M. P.

EDUCATIONAL POLICIES COMMISSION. *American Education and International Tensions.* Washington, D. C.: Educational Policies Commission of the National Education Association, 1949. 54 p. $0.25.

Three phases are considered regarding international tensions: the outlook, the educational program, and channels for action.

C. M. P.

THE CHRISTIAN SCIENCE MONITOR: *What Is Democracy? America's Schools Are Writing the Definition.* Washington, D. C. Office of Education, Federal Security Agency, 1949. 40 p.

This is a series of articles reprinted from *The Christian Science Monitor* under the general title *Education for Freedom.* The series was composed of a total of twenty articles, mostly by staff writers of *The Christian Science Monitor.* This is quite a timely compilation in view of the recent series of trials that have been featured in newspaper columns and on the radio.

C. M. P.

ELLIOTT, GODFREY M. *Film and Education.* New York: Philosophical Library, 1948. 597 p. $7.50.

Film and Education is a symposium on the role of the film in the field of education. Thirty-seven individuals write on various aspects of the motion picture in school and community life. The writers were especially selected because of their competence in that area. They have tried to write in such a way that all those who use and work with film can derive the maximum benefit.

The various sections are: the nature of the educational film, the educational film in the classroom, the educational film outside the classroom, the educational film abroad, and the administrative problems and practices.

The second section deals with the specific values and uses of films in various subject matter areas. Dr. Oreon Keeslar, Bakersfield, California, discusses the applications of the film in science. He says a science film should be used to depict these unique functions: (1) Methods or processes not directly demonstrable, (2) Action observable only vicariously, (3) Observable action simplified through animation, (4) Unobservable action depicted through animation, (5) Slow-motion, (6) Time lapse through recorded sound or sound effects. In addition science films may have certain specialized functions as in (1) Photomicrography, (2) Miniature photography, and (3) The human elements of science depicted through the dramatic medium of the film. Existing science films are not entirely satisfactory teaching aids.

Teachers of visual-aid courses, directors of visual-aid programs, and users of films will find this the most useful challenging book now available in the area of the educational use of films.

C. M. P.

ZINMAN, MEYER E. *Shorthand in One Week.* New York (215 West 91 Street) 24: Meyer E. Zinman, 1949. 25 p. $2.00.

The author asserts that by the system described in this booklet shorthand can be learned in thirty-six hours or less than one week. The system is based on longhand and is designed for self instruction. Numerous testimonials assert the persons have learned the system in one week because of its simplicity. In classes where it has been taught students have been able to develop a speed of 40 to 70 words a minute on simple business matter. C. M. P.

SYMPOSIUM. *Higher Learning and the World Crisis.* Washington 6, D. C.: Department of Higher Education of the National Education Association, 1948. 22 p. $0.25.

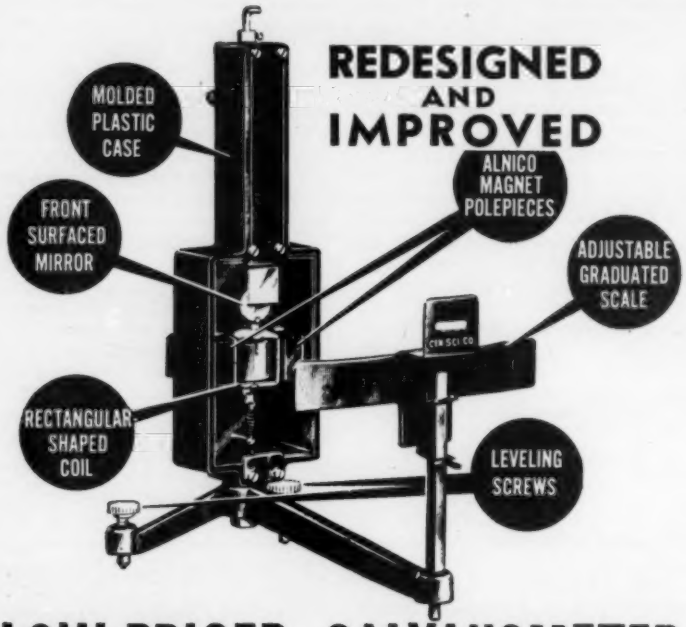
Three addresses delivered at the annual meeting of the Department of Higher Education in Cleveland, Ohio, on July 5, 1948, are included. These are: *The Role of the University in Building World Peace* by Ernest O. Melby, *Science and Human Progress* by Andrew Conway Ivy, and *Machines and Ideas in World Cooperation* by Franklin Porter Graham. C. M. P.

MCDONALD, RALPH W., AND MCCASKILL, JAMES L. *Current Trends in Higher Education.* Washington, D. C.: Department of Higher Education; National Education Association, 1948. 199 p. $2.00.

This is a report of the National Conference on Higher Education held at Chicago, Illinois, March 22–25, 1948. Twenty-two papers are listed under the following general headings: Finance, Student Personnel, Curriculum, Faculty, and Organization. C. M. P.

SYMPOSIUM. *Childcraft.* Chicago (35 East Wacker Drive): Field Enterprises, Inc. 1949. $69.50.

When one first examines and reads some of the material in this fourteen volume *Childcraft* series you feel like saying, "Here's what I have been wanting and hoping for all of these years." It



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seems to be precisely the kind of an encyclopedia that every elementary teacher has been desiring consciously, or unconsciously. The colored illustrations alone are worth the price of the books. They are full of appeal to both teachers and pupils. Many pictures are so vivid and expressive that they give a most satisfying educational experience in themselves. The illustrated stories are so much more meaningful to children.

Brought together here is much of the material that many teachers have been using in their class rooms or have hoped they could find somewhere. The selection of material was done by experienced teachers and curriculum experts. These include Ernest G. Osborne and Jean Betzner of Teachers College, Columbia University, William E. Blatz of the University of Toronto, Mary S. Fisher Langmuir of Vassar College, Lois Meek Stolz of Stanford University and numerous consultants and contributing artists.

Childcraft is comprehensive, unbiased, authoritative. There is material suitable for children in each grade level and of such variety and appeal that any child having even the slightest interest in reading will find something especially appealing to learn. It is an equally rich resource for the teacher and the parent, too. Here are numerous stories to tell and read to children at the various grade levels. There are numerous suggestions on what to do and how to do it. The subject matter material is carefully classified and indexed. Teachers' aids have been carefully planned. *Through the Year* gives many suggestions for use of *Childcraft* material for each month in the year. A series of child guidance leaflets especially prepared to help parents and teachers in the solution of everyday child guidance problems are available at relatively little cost. Purchasers of *Childcraft* are entitled to special informational service on child guidance and child training furnished by the *Childcraft Advisory Service.*

Certain volumes such as Nine to Twelve inclusive are especially for the teacher and parent. The material here is designed to give parents and teachers a better understanding of the child and hence should result in better parents and teachers.

Childcraft is in keeping with the best thought in curriculum development in its inclusion of a relatively large amount of elementary science material. Volumes Four, Seven, and Fourteen are wholly devoted to science material and other volumes such as Eleven have some valuable science material, too. The science material seems to be unusually well selected from the best elementary science material now available.

Briefly the content of each volume follows: One—Mother Goose and Nursery Rhymes, The World About Us, Fun and Fancy Stories; Two—Poems for Everyday, Humorous Poems, and Storytelling Poems and Ballads; Three—Favorite Nursery Stories, Folk and Fairy Stories, and Aesop's Fables; Four—Animal Friends, Wheels, Wings, and Real Things; Five—Holiday Stories, Children of the Americas, and Stories of Many Lands; Six—Adventures of Famous Persons and Bible stories; Seven—Exploring the World Around Us; Eight—Creative Play and Hobbies; Nine—The Growing Child; Ten—Guidance and Development; Eleven—Ways of Learning; Twelve—Guidance for Development; Thirteen—Art and Music; and Fourteen—Science and Industry.

Altogether *Childcraft* is an unusually fine set of books for the home, the school, and the teacher. Many new processes have been utilized in making the set most artistic and appealing. Carefully selected material by experienced teachers and curriculum workers along with the practical suggestions and helps make this the best encyclopedia now available for the grade school child, his parents, and his teachers. It would seem that a school could not make a better investment than to have *Childcraft* made available in each elementary school. It would be an equally good investment in any home having elementary grade children.

INTRODUCING THE CONTRIBUTORS

(Continued from page 260)

New York City. College teaching includes College of the City of New York, Brooklyn College, Colorado State College of Education and the University of Colorado. He is the author of numerous articles, tests, and books, including the well known *Science in Our Lives* (with S. P. Unzicker) and *Biology and Man* (with N. E. Bingham).

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